ENVIRONMENT AND FOREST MANAGEMENT IN INDIA

THESIS

SUBMITTED FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy

IN

ECONOMICS

BY

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UNDER THE SUPERVISION OF

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Certificate

This is to certify that **Ms. Bilquees Azra** has carried out her research work entitled "**Environment and Forest Management in India**" under the supervision of the undersigned.

The research work is an original piece of work and quite fit for submission to the examiner for the evaluation of Ph.D thesis.

Azra Musavi

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Supervisor

Acknowledgments

This thesis is the ultimate product of my arduous and long journey to achieve my goal. It has been kept on track and been seen through to completion with the support and encouragement of numerous people including my well wishers, friends and various institutions. At the end of my thesis, it is a pleasant task to express my thanks to all those who contributed in many ways to the success of this study and made it an unforgettable experience for me.

At this moment of accomplishment, first and foremost, I bow my head humbly before the Almighty ***ALLAH*** *who provided me opportunity, determination and of course patience to complete this research work.*

I express deep sense of gratitude and thankfulness to my supervisor, ***Dr. Azra Musavi,*** *Assistant Professor, Department of Economics, Aligarh Muslim University, for her guidance, encouragement and constructive criticism throughout my research work. She has helped me at each and every point of my research with patience and enthusiasm in spite of her busy schedule.*

I sincerely thank ***Prof. Abdul Wahab,*** *Chairman, Department of Economics, Aligarh Muslim University, for providing the necessary facilities to complete this work. I would like to record my special thank and deep gratitude to all the teachers of the department, especially* ***Dr. Abdus Salam, Dr. Mohd. Tariq*** *and* ***Prof. Nisar Ahmed*** *for their valuable support and encouragement during my research work.*

I also wish to thank ***Mr. Aqeel, Mr. Ghazanfar, Mr. Buniyad,*** *and all the non-teaching staff of the Department of Economics for their time to time assistance.*

Let me record my sincere thanks to the University Grants Commission for awarding me the Maulana Azad National Fellowship which bolstered me to perform my work comfortably.

My grateful thanks go to some of my seniors especially ***Malik Yasir, Naheed Akhtar, Falak Butool*** *and* ***Uzma Khan*** *who gave me valuable suggestions and with whom I had discussions and exchanged views on various aspects of my work.*

As a special gesture of appreciation, I would like to thank all my friends especially ***Nyla, Farhat, Naseem, Priya, Andaleeb, Ghazala, Shabana, Fariha, Kehkashan and Shariya,*** *for their support and encouragement. Special and heartfelt thanks to my dearest friends* ***Tauseef, Deeba, Sadaf and Mridula*** *for their unfailing support and affection.*

*Finally, words will never be enough to express my gratitude to my parents (****Mr. Alamdar Naqvi*** *and* ***Mrs. Kaneez Azra)*** *and my younger brothers (****Shams*** *and* ***Qamar)*** *for their blessings and moral support. They have always believed in me and helped me reach my goals. Their support forged my desire to achieve all that I could in life.*

(Bilquees Azra)

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter - 1

Introduction

INTRODUCTION

The level of a country's economic development, the availability of natural resources and the life style of its population are closely related to the level of the environmental health of a country. Environmental resources provide the foundation for sustainable development. Fertile soil, clean water, biomass and biodiversity produce a range of goods and services that yield income, offer safety nets for the poor, maintain public health, and increase economic growth. Conversely, bad management of environmental resources, poor control of environmental hazards inadequate response to environmental challenges such as climate change, threatens development.

India is one of the 17 mega-biodiversity countries of the world. In about 2.4% of the total geographical area of the world, India has 45,500 plant species and 91,000 animal species representing about 7 % of the world's flora and 6.5 % of the world's fauna (MoEF, 2009a).The forest wealth in India is extremely diverse because of massive variation in the topography of the country. They assume a great significance in Indian economy by providing a range of social, economic and ecological services. The forestry sector plays an important role in ensuring equitable and inclusive growth along with protecting natural heritage for ensuring sustainable development. Forests have the potential to improve the livelihoods of forest dwelling people, particularly tribal people, who are among the most disadvantaged groups in Indian society. About 275 million poor rural people in India (27% of total population) depend on forests for at least part of their subsistence and cash livelihoods. Forests meet nearly 40% of the energy needs of the country, of which more than 80% is utilized in rural areas. Apart from these, forests are the reservoirs of India's rich heritage of biodiversity and

provide home to various plants and animals. About 27.8% of the total recorded forest area of the country is dedicated to the protection of wildlife habitat and is maintained under the protected area network (FSI, 2011). Forests also act as carbon sinks and help to maintain the fertility of the soil, protect watersheds, and reduce the risk of natural disasters, such as floods and landslides.

However, despite their great economic and ecological value, forests are one of the country's most mismanaged resources. They are under severe biotic pressure and are increasingly being degraded due to intense pressure from a range of human and biophysical causes. While India has only 2.4 % of the world geographical area, it has 17% of the world population and 18% of livestock. An estimated 41 percent of India's forest cover has been degraded to some degree in the past several decades (MoEF, 2006a). Moreover forest productivity in India is also very poor as compared to the global average. The annual productivity of India's forests is only 1.34 per cubic-meter/hectare/annum as compared to the world average of 2.1 per cubic-meter/ hectare/ annum (The Eleventh Five Year Plan, 2007-12). According to the India State of Forest Report (ISFR) 2011, forest cover of India is 69.20 million ha, which constitutes 21.05 % of total geographical area of the country. However, this falls short of the national goal (National Forest Policy 1988) of 33 % of land area under forest cover. Apart from this, out of the total forest cover of 21.05 %, only 12.3 % of forests are under dense forests, with high ecological value, the remaining 8.75% are under open forests which are primarily degraded (FSI, 2011).

Besides these, the quality of other natural resources like water and air has been deteriorating continuously in India. The Ministry of Water Resources (2003) estimated that almost 70 percent of India's surface water and a growing percentage of

groundwater reserves were contaminated by biological, toxic, organic and inorganic pollutants. In many cases, these sources were found unsafe for human consumption as well as for other activities such as irrigation and industrial needs. The degraded water quality also contributes to water scarcity by limiting its availability for both human use and the ecosystem (MoEF, 2009a). Moreover, the per capita availability of water in India was only 2,170 cubic meters which was much lower than the Asian average of 3,370 cubic meters (Mohan, 2008). The air pollution in India's major cities has also crossed the level of tolerance. Though the per capita emission of air pollutants in India were much lower than the Asian average, they have crossed the permissible level in most of the cities like Delhi, Ahmadabad, Mumbai, Baroda, Thane, Chennai, Kanpur, etc. Air pollution and its resultant impacts can be attributed to emissions from vehicular, industrial and domestic activities. The Ministry of Environment and Forest, in its State of Environment Report, 2009, reported that India's urban air quality ranked amongst the worst in the world (MoEF, 2009a).

Statement of the Problem : High population growth, poverty, inappropriate technology and consumption choices have an adverse impact on the environment. Moreover, intensive agriculture, polluting industry and unplanned urbanization have further contributed in deterioration of the environment. In India, millions of poor people still continue to live far below the minimum levels required for a decent human existence; deprived of adequate food, clothing, shelter, education, health and sanitation. Poverty and lack of alternatives are the forces which drive rural people in India to depend on open access resources like forests, pastures, and water resources leading to their over-exploitation. The consequence of environmental degradation is manifested in the form of severe health problems to the people. According to WHO (2007), lack of water, sanitation, and hygiene resulted in the loss of 0.4 million lives

while air pollution contributed to the death of 0.52 million people annually in India. The study by McKenzie and Ray (2004) also showed that India lost 90 million days a year due to water borne diseases with production losses and treatment costs worth Rs 6 billion. Thus, if the factors of production are adversely affected due to the environmental damage, it will undermine future attainments and productivity of the economy. Similarly, as forests have great significance in Indian economy in terms of various social, economic and ecological contributions, the large scale degradation of these resources also results in a huge social, economic and ecological cost.

Justification of the Study : While India has been able to attain rapid industrial and economic growth since independence, it is also facing accelerated depletion of its natural resources and rapid deterioration in environment quality, which if left unaddressed would in the long run adversely affect the sustainability of India's growth and development. The present study is an attempt to examine the status of India's environment and forests as well as to examine the efficacy of various administrative and legislative measures adopted for management of India's environment and forest resources. Based on the findings, suitable policy measures would be suggested for the conservation and proper management of the environment and forests.

1.1 Historical Perspective

Pre-colonial Period

The concern for environment and forests has been a traditional part of ancient Indian society. Various scriptures like the *Vedas*, the *Mahabharata*, the *Ramayana*,

etc. give attractive descriptions of forests of that period. Trees were worshipped and rivers were considered as goddesses. The *Puranas* describe various direct and indirect benefits from forests. *Rishis* warned against deforestation as they thought that this would result in poor rainfall. A poem in the *Yajur Veda* invokes universal peace with special mention of the "peace of air, peace of earth, peace of water, peace of plants, and peace of trees." This reference to *Vedic* poetry reveals the responsiveness of Indian sensibility to the benediction of nature (Agarwala, 1985). The ownership of forests resided with the rulers of the various kingdoms across India. Forest management was aimed at the welfare of all sections of the society. For example, the Maurayan Empire (324 BC to 180 BC) used a forest classification system, based on the requirements of different social strata: reserve forests for the king or the state; forests donated to eminent Brahmans; and forests for the public (Dwivedi, 1980). With few exceptions, access to forests was largely unrestricted throughout the pre-British period (Guha, 1983). At the village level, the use of all natural resources was managed by a local community institution known as the *Panchayat*, composed of five village elders who managed all village affairs. A significant part of their duties revolved around settling disputes over land, access to water, and mediating conflicts among villagers (Guha, 1989).

Colonial Period

The British came to India for the purpose of trade and commerce and established the East India Company in the sixteenth century. Later, in the second half of the eighteenth century, the advances in technology brought about by the industrial revolution, led to the large scale destruction of natural resources in India. As Gadgil and Guha (1992) reported that "the revolution in the mode of resource use, brought

about by industrialization, enormously enlarged the possibilities of transforming resources from one form to another and of transporting them over large distances. With these technological advances, a wide range of objects became commodities, the objects for which the demand could go on increasing indefinitely, almost limitlessly". They illustrated that wood, which was consumed only on a limited scale in a subsistence economy, could be converted into paper or burnt for fuel for the steam engines of trains and ships. This easy access to resources resulted in large scale exploitation of forests and other natural resources in India (Gadgil and Guha, 1992).

The exploitation of natural resources was further intensified when the British achieved supremacy in India in middle of the eighteenth century. Among British colonies, "India stood pre-eminent by the seemingly immeasurable extent of its natural resources" (Rozencranz, Divan and Noble, 1991). They were under the impression that India's wealth in terms of various natural resources, especially in terms of forest wealth was inexhaustible. Therefore, the early days of British occupation were characterized by a total indifference to the needs for forests conservation. Rather, a very large proportion of the country's forests were destroyed as they needed timber for military purposes, for teak export trade and to build railway network in India (Stebbing, 1982). Besides these, the revenue orientation of colonial land policy also worked towards the denudation of forests. As the removal of forests added to the class of land assessed for revenue, forests were considered 'an obstruction to agriculture and consequently a bar to the prosperity of the Empire' (Gadgil and Guha, 1992).

A turn came with the Dalhousie Memorandum in 1855, in which, the Governor General of India declared "all teak and similar timbers to be the property of

the Government of India and made cutting without Government authorization a criminal offence" (Prabhakar, 1998). In order to assert and maintain state control over forests, an imperial Forest Department was formed in 1864. Following the establishment of the new department, the Indian Forest Act was passed in 1865 as the first attempt to assert state monopoly right over forests. The act was replaced by a more comprehensive piece of legislation in 1878. The provisions of the 1878 Act ensured the demarcation of the valuable tracts of forests, needed especially for railway purposes. Besides maintaining strict state control, the 1878 Act also provided for scientific management of forests enabling the working of compact blocks of forests for commercial timber production (Gadgil and Guha, 1992).

The value of India's forests was fully realized by the British Empire during the period of the two World Wars. During the First World War (1914-1918), large quantities of timber of different species and bamboo were supplied for the construction of bridges, buildings, ships, huts, etc., resulting in excessive felling of trees. As reported by Smythies (1925), that, in little over a year from April 1917 to October 1918, about 228,076 tones of timber (excluding railway sleepers) were supplied by the specially created timber branch of the munitions board, and 50,000 tones of fodder grass were exported to help military operations in Egypt and Iraq. Approximately 1.7 million cubic feet of timber were exported annually between 1914 and 1919. Besides this, the impact of the Second World War (1939-45) was more severely felt on Indian forests. Early in 1940, a timber directorate was set up in Delhi to channel supplies of forest produce from the provinces (Gadgil and Guha, 1992). Moreover, there was extensive over felling in forests of Indian Princely States. It has been noted that many timber species which had not been previously exploited in large quantities were being consumed in large quantities at that time (Agarwal, 1985).

Thus, the entire British period in India was characterized by the treatment of Indian forestry on commercial lines. The sole purpose of forest management was to redistribute economic gains in favour of the Empire.

Post Independence Period

After independence, the Government of India initiated a number of programmes regarding environment and forest management in India. A significant step towards forest management was the adoption of the revised National Forest Policy in 1952. However, the policy was initiated to allow exclusive control of the government over forest management (Murali, *et al.*, 2003). The emphasis of forest management regimes continued to be commercial timber exploitation and the exclusion of local people (Kant and Cooke, 1999). Serious attempts for protection of environment and forests in India were started in 1970s after the Stockholm Conference of 1972. The Government of India took a number of steps to implement the decisions taken at the Conference by means of amendments to the Constitution, new legislations relating to environmental protection and creation of institutions for implementing the legislations. Two major acts- the Wildlife (Protection) Act 1972 and the Water (Prevention and Control of Pollution) Act 1974 were enacted by the Parliament of India. Besides, the new Fundamental Rights and Duties of Citizens were added to the Constitution. The provisions made in Article 48-A and 51-A of the Constitution by the 42nd Amendment in 1976 gave directions to the state for the protection of environment (Article 48-A) and also imposes duty on every citizen to help the preservation of natural environment (Article 51-A). The Parliament enacted the Forest (Conservation) Act in 1980 and the Air (Prevention and Control of Pollution) Act in 1981. Institutions like Central and State Pollution Control Boards

were also created for implementing the provisions of the Acts. The Bhopal gas tragedy in 1984 resulted in the passage of a comprehensive environment legislation viz., the Environment (Protection) Act in 1986.

In 1988, the second National Forest Policy was announced and India had taken a revolutionary shift from a 'regulatory' to a 'participatory' approach of forest management with the promulgation of this Policy. This Forest Policy embodied all elements of sustainable forest management and India's forests started to be treated as social and environmental resources (Anon, 2006). The implementation of this policy was initiated in a major way to involve local communities in the conservation, protection and management of forests through Joint Forest Management (JFM) institutions in 1990.

Since 1990s, the Government of India's policy towards environment and forests was guided by the principles of Agenda 21, which was adopted at the Earth Summit held at Rio de Janeiro in 1992. Consequently, a number of policy statements and notifications were issued by the Government of India for integrating environmental concerns in the development process. These include, the Policy Statement for Abatement of Pollution (PSAP) 1992, the National Conservation Strategy and Policy Statement on Environment and Development (NCS-PSED) 1992 and the Environmental Impact Assessment (EIA) notification 1994. In 2006, the first National Environment Policy was initiated with the key environmental objectives of mainstreaming environmental concerns in economic and social development and conserving environmental resources.

1.2 Review of Literature

The growing concerns over environment and forest degradation have received great deal of attention all over the world resulting in a large amount of literature on the subject. Majority of India's population is dependent on forests for their livelihoods. There are several studies which have highlighted the significant role of forests towards securing the livelihood of poor people living in and around forests (Singh *et al.*, 2005; Kumar *et al.*, 2000). Nayak, *et al.* (2012) pointed out that people are dependent on forests for their food and medicinal needs, agricultural implements, house construction, livestock as well as for shelter. Sunderlin, *et al.* (2005) have examined that apart from providing food, shelter and fuelwood for cooking, forest and tree resources also function as 'safety nets' in times of difficulties of the surrounding households who are entirely dependent on this natural resource. Some other studies viz., Kumar, *et al.* (2010), Vedeld *et al.* (2004) and Bahuguna (2000) have highlighted the role of forests in providing subsistence income and employment to rural households. While Vedeld *et al.* (2004) observed that forest products contributed between 20% to 40% total income of households in forest areas, other estimates in India by Bhattacharya and Hayat (2004) and Angelsen and Wundeder (2003) indicated a range between 10% to 54%. Apart from these, Saha and Sundriyal (2012) examined the importance of Non-Timber Forest Products (NTFPs) in social and traditional life of forest dependent population and found that nearly 400 million people living in and around forests depend on NTFPs for sustenance and supplemental income.

Singh *et al.* (2009) highlighted the immense potential of forests towards alleviating poverty of the forest dependent communities, provided institutions-based

scientific management is strengthened. Several other studies (Rao, 1994; Jodha, 2000; Narain, Gupta and Veld, 2005) have established the link between poverty and environment in developing countries by analyzing the dependence of rural households on common property resources. However, a study conducted by Kumar *et al.* (2000) noted that forests contributed in poverty reduction by generating revenues for the government, which in turn are made available for developmental programmes like promotion of income generating activities.

Jodha (2000), however argued that heavy dependence of poor on open-access resources (Common Property Resources or CPRs) like forests, pastures, and water resources lead to their over-exploitation. Similar view was held by Nayak *et al.* (2012) who examined that it was the livelihood dependence of millions of poor people living in and around forest, which contributed to forest degradation along with other factors. According to him, widespread poverty and lack of other income generating opportunities often made forest dependent communities to resort to over-exploitation of forest resources. Some field based studies assessing the pattern of collection of various forest products and its impact on local forests also found that local livelihood dependence resulted in degradation (Davidar *et al.*, 2010; Mishra *et al.*, 2008; Arjunan *et al.*, 2005; Sagar and Singh, 2004). Abbot and Homewood (1999) witnessed the decline in forest cover and modification of tree species composition due to large human pressure on forests in Zambia.

Dasgupta and Maler (1994) and Maler (1997), however have argued that it was because of weak property rights and limited access to credit, insurance and capital markets that rural poverty lead to resource degradation in many ways. There is a widely held view, particularly in the west, that poverty is the main cause of

environmental deterioration because the poor are not in a position to use natural resources sustainably (Duraiappah, 1996, Prakash, 1997). Nadkarni (2000) observed that poor are perceived as having a short time horizon, discounting the future benefits from conservation rather heavily owing to the urgency to make a livelihood and avoid hunger. Such time horizons lead to unsustainable use of natural resources.

Out of the various resources for which local communities / poor people depend on forest resources, fuel wood extraction and its impact on environment and forest seem to have got a lot of attention, especially in developing countries of Asia and Africa (Adhikari, *et al.*, 2004; Amacher *et al.*, 1993; 1996; 1999; Baland *et al.*, 2010; Heltberg *et al.*, 2000; Mekkonen, 1999). However, in the evaluation of the environmental impact of firewood collection, forest degradation rather than deforestation was emphasized because the former was deeply linked to the behavior of local population, including firewood collection, over-grazing, fires, whereas the latter was mostly due to forest exploitation and commercial logging (Durrappah, 1998; Trossero, 2002; Wunder, 2001). In developing countries, fuelwood accounted for 80% of all household energy consumption (Sharma and Banskota, 2005) and was a major cause of accelerating pressure on forests (Pattanayak, *et al.*, 2004). Arnold *et al.* (2003) too have regarded the massive removal of woody biomass for meeting fuelwood demand, as the major factor leading to forest degradation and destruction. They argued that as the poor have no alternative to fuelwood or other locally available organic materials, one consequence of growing rural population is an inexorable growth in the pressure on locally available forest resources and other sources of woody material. In another study, Ghilardi *et al.* (2009) have pointed out that although fuelwood extraction may not be a major cause of deforestation, excessive tree cutting is a significant problem in some areas, particularly near large and growing

urban centers. According to them, wood removal even at low rates, can adversely affect the structure, growth and composition of natural forests.

Apart from fuelwood extraction, several other anthropogenic pressures like over grazing, shifting cultivation, and vulnerability to forest fire, which were directly linked to the livelihood of the forest dependent poor communities, were also been regarded as factors responsible for forest degradation (World Bank, 2006; Bahuguna *et al.*, 2002; Davidar *et al.*, 2010; Aggarwal *et al.*, 2009; Panda and Das, 2009; Bhat *et al.*, 2001). For instance, Nayak *et al.* (2012) examined that over and unregulated grazing in forest areas adversely affected the growing stock as well as regeneration capacity of forests. On the other hand, shifting cultivation, agricultural and pastoral encroachments were regarded as the major causes of deforestation by Westoby (1991) and Cruz (1990).

Despite the dominant view in the literature that poverty and local people's dependence on forests caused environmental degradation, there were some contradicting empirical evidences. Studies by Triffen, *et al.*, 1994 showed that traditional communities had managed the resources efficiently despite their poverty. Nadkarni, 1990 and Nadkarni and Pasha, 1991 found that the poor population was not responsible for the depletion the natural environment. While investigating the relationship between poverty and deforestation in Tangail Division of Bangladesh using site visits, interviews and a small questionnaire survey, Chowdhury and Sarwar (2008) also found that poor people were not the agents of environmental degradation. The results indicated that contrary to common beliefs, in general, depletion and degradation of forest resources were caused by encroachers (who were usually powerful and rich) and to some extent by the negligence of Forest Department staff

who did not have the skill, will or resources to protect and conserve forest resources. The findings were based on a survey of 160 randomly selected households in the study area.

Several researchers have found that the poor too had a concern for the future and they were conscious of their stake in the sustainable use of natural resources. According to Prakash (1997), poor farmers put in a tremendous amount of planning and labour into building and maintaining terraced fields, controlling soil erosion and nurturing tree species for fuel, fodder and soil fixing. According to him, the poor appeared to degrade the environment because of lack of incentives and appropriate institutions, including lack of clarity on property rights. Jodha (1986) pointed out that it was the local control over natural resources and adherence to social sanctions that empowered the community to protect and enhance community stake in natural resources and enforce measures which helped in balancing supply and demand aspects of resource use in the community context. The existence of sacred groves and '*van panchayats*', which have evolved over years to refrain indiscriminate exploitation of forests, and that of '*pani panchayats*' (Deshpande and Reddy, 1990) for managing irrigation tanks and canals showed the necessary vision and ingenuity of rural people of developing countries to promote sustainable and equitable use of resources.

There is a large body of literature which regarded population growth as prime cause for environmental degradation. Southgate (1988) as well as Ives and Messel (1989) cited population growth as the prime contributor to exploitation of forests, especially in tropical Africa, and the Amazon basin. Similarly, Mink (1993) and a FAO study (1993) concluded that agricultural expansion driven primarily by

population pressures was the principal cause for tropical deforestation. The studies pointed out that population pressures as well as government policies which provided incentives for people to move into these areas played a large part in converting large tracts of forest lands into permanent agricultural lands. However, no explicit link was made between poverty and population in either study.

Minde *et al.* (2001) also attributed the problem of forest clearing to population pressure which was said to be forcing people to clear forest land for agriculture. Place and Otsuka (2001), Minde *et al.* (2001), Walker and Peters (2007) and Mwase *et al.* (2007) regarded the conversion of forest land into agriculture as the major source of deforestation were done by While examining the linkages between poverty and environmental degradation in Malawi (Hamilton, New Zealand), Mkwar and Marsh (2009) also found that deforestation had resulted from conversion of forest areas into agriculture due to the cultivation of subsistence and cash crops.

With regards to agriculture, it was widely argued that in most poor countries, particularly in sub-Saharan Africa, the rural poor rely on low-productivity, subsistence agriculture for their living. This being the case, with no or very limited technological improvement, agricultural production can only be enhanced by converting forests into agricultural land (Coxhead and Jayasuriya, 2004; Lufumpa, 2005).

Gulati and Sharma (2000) argued that low productivity of forest coupled with ever-increasing demand for forest products due to India's huge and increasing population contributed to the degradation of forests. While examining the causes of deforestation for Asia, Africa and Latin America over the period 1961-88, Cropper and Griffith (1994) found a positive relationship between deforestation and population

growth and rural population density. In a similar study of the causes of deforestation in Thailand's poorest region, during the period 1973-82, Panayotou and Sungsuwan (1992) found that population density was the most important factor leading to deforestation; other factors were poverty, wood price and agricultural yields. Forest encroachments for conversion to agriculture and progressive shortening of the fallow cycle from 10-15 years down to 4-6 years were regarded as channels through which increasing population density resulted in deforestation and reduced forest regeneration. Two other factors, artificially high fertilizer and kerosene prices, further exacerbated the effect of high population density on deforestation by acting as "taxes" on agricultural intensification and fuel substitution, respectively.

Tongpan and Panayotou (1990) extended the study period to 1988 and found similar results: a ten percent increase in the rate of population growth was associated with a 3.3 percent increase in deforestation. Varshney (1993) also illustrated the impact of rapid population growth on resource availability and environmental quality in India. Loss of forest cover, deforestation, land degradation, pollution of air, water and soil, global warming and acid rain had been regarded as major consequences of population growth. However, in a study of forty tropical countries Panayotou (1993) found that it is the strong interaction between population density and income per capita that determined deforestation rather than simply population density, suggesting that population density affected the environment differently at different stages of economic development. Saxena and Nautiyal (1997) also argued that both the number of people and their socioeconomic conditions have a significant impact on deforestation and concluded that population had to be considered as a causal factor of deforestation only in context of other factors.

Moreover, there are a large number of studies on the likely impact of economic growth on environmental resources, especially in developing countries (Arrow *et al;* 1995, Dasgupta and Maler, 1995; Dasgupta, *et al.,* 2000). In India, a number of studies examined the harmful and adverse affects of economic growth, industrialization and urbanization on the quality of environment (Karunakaran, 1996; Mishra, 2000; Raghupathy, 2002).

While Bowonder (1986) identified that it was the interacting effects of industrialization, urbanization and poor environmental management practices that caused environmental degradation in India, some other authors like Mishra, 2000; Chopra *et al.,* 1993; Raghupathy, 2002 and Jain, 2009 blamed indiscriminate pattern of economic development for unsustainable exploitation of natural resources. The major environmental problems discussed in these studies were loss of farming capacity, deforestation, air and water pollution, soil pollution from pesticides, mushrooming growth of squatter settlements and poor sanitation. Batta and Bhatti (2001) attributed environmental problems in developing countries like India, developmental activities due to their failure in solving such basic problems as poverty, unemployment, inequalities and low growth rates. The uneven spatial distribution of population relative to the earth's natural capacity was regarded as another factor responsible for environmental degradation.

Mukherjee and Kathuria (2006) investigated the relationship between environmental quality and per-capita National State Domestic Product (NSDP), Environment Kuznets Curve, EKC) of 14 major Indian states in the light of their high economic growth in the post-liberalization period. It was found that the economic growth was mostly at the cost of environmental quality. A similar study by Jain

(2009) examined the relationship between development pattern and environment quality and deforestation in various districts of Gujarat in India. The pattern of development was determined by using various development indices like agricultural development index, industrial development index and indices of income, education, health, housing, participation and basic services. These indices were further constructed on the basis of the methodology adopted by UNDP. The results indicated that Gujarat, which was one of the developed states of the country, was one of the deficit states in terms of the quality of environment. It was found that the districts which had taken a lead in economic development had lagged behind in terms of quality of environment. A high rate of deforestation was also found in these districts. Thus, in Gujarat, economic development had taken place at the cost of environmental deterioration. While exploring the conflict between environment and reckless exploitation of earth, Ramesh (2010) accepted a trade-off between growth and environment. Agarwal,1998; Srivastava and Chundi, 2000; Mohapatra, 2003 and Singh, 2009 also blamed the excessive use of chemical fertilizers, pesticides, and high yielding hybrid seeds in the agriculture sector for degradation of environment in India.

Bowonder, 1986; Ostrom, 1990; Agarwal, 1998; and Eric *et al.,* 2010) blamed weak government involvement and inadequate institutional framework for degradation of natural resources and environmental problems. Eric *et al.* (2010) pointed out that in the absence of planning and productive employment due to weak government involvement, rapid urbanization had created problems like poverty and inequalities, environmental degradation, unplanned sprawl and wastes in big cities of Congo. A Similar view was also held by Bowonder (1986) for India, who regarded lack of political commitment and comprehensive environmental policy, poor

environmental awareness, and functional fragmentation of the public administration system, as major factors responsible for increasing the severity of these problems. Ostrom (1990) argued that the degradation of common property resources resulted from an inadequate institutional framework, which did not provide rural households with suitable incentives for rational and sustainable resource management. Lubna, *et al.* (2008) also blamed state failure in managing forests for the problem of deforestation in Pakistan. D'Silva, 1994 identified Non-accounting of the value of various forest goods and services, lack of community involvement and technological constraints were identified as main factors responsible for state failure in forest management.

A number of studies *viz* Nagal, *et al.,* 2008 and Ramesh, 2010 also discussed the consequences of various environmental problems, especially of air and water pollution While examining the affects of air pollution on human health, Nagal *et al.* (2008) observed that air pollution from industries and automobiles caused a number of diseases like lung cancer, asthma, etc. On the other hand, Behra and Reddy (2002) examined the effects of industrial pollution on agriculture sector of India. According to them industrial pollution caused water pollution and this polluted water, when used for irrigation, adversely affected land productivity. Reddy *et al.* (2001) examined the extent of forest degradation at the state level in India and identified its economic and ecological consequences. The real cost of such degradation resulted in declining productivities of interlinked natural resources such as land, water, grasslands, etc.

Most of existing studies that compared 'state-managed forests' with those 'community-managed forest' underlined the relative effectiveness of the latter. For instance, Somanathan *et al.* (2009) evaluated forest quality using data from satellite

images in two regions of Uttarakhand. They compared crown cover of forests across three types of forest management regimes: *Van Panchayat* forests, open access forest (unregulated), and State forest. It was found that on average the crown cover of *Van Panchayat* forests was significantly higher than open access forests (12% for broad-leafed forests), and similar to State-managed forests. The authors further compared these results with forest management costs; the costs of state management were 13 times higher per hectare of forest than those for *Van Panchayat* management. While the results showed absence of significant differences between open access forests and state forests, the forests managed by *Van Panchayats* displayed significantly lower rates of lopping. It was also consistent with the results of Baland *et al.* (2007) for India, who observed a significant decline in firewood collection in villages with a larger fraction of neighboring forests under *Van Panchayat* management. Although setting up a formal community management structure therefore appears effective in terms of improving forest quality, it also has important effects with respect to redistribution, as it changes the rules for using and sharing forest produce.

While discussing the importance of decentralized system of forest management, Kotwal *et al.* (2008) argued that a scientific approach of forest management to provide maximum benefits to the stakeholders were possible only by implementing and operationalizing sustainable forest management through local communities. Similarly, Prasad and Shashikant (2003) outlined the contribution of Joint Forest Management (JFM) in forest management as well as in achieving sustainable human development (SHD). They stated that the community-based institutions under JFM had proved very useful and had contributed to forest management as well as to the four aspects of SHD- ecological output, income generation, village infrastructure development and community empowerment.

However, Reddy *et al.* (2001) found a weak link between JFM and improving the condition of forests.

Murali *et al.* (2003) regarded benefit sharing as one of the strongest reasons for acceptance and success of community participation in India. It was reported that in cases where communities were encouraged to share responsibilities and benefits, forest degradation declined or ceased, as was obtained from the evaluation of the first JFM in India. However, in areas where communities were not involved in shared responsibilities and derived benefits, degradation had accelerated (Poffenberger *et al.*, 1990, Matose and Wily, 1996).

There are many examples of inadequate and unsustainable management of the forests by central governments both in developing countries and developed countries (Anderson, 2000). Some authors have pointed out that management of forests exclusively by central government was not sustainable as they lacked both financial and human capacity (Bojang and Reeb, 1998; Brown, 1999; Anderson, 2000; Fabricius, 2004; and Luoga, 2006). The importance of empowering local communities in planning, implementation and monitoring local forest conservation to prevent loss of forest resources was also pointed out by Lise (2000) and Ham *et al.* (2008).

While it is true that centralized state management, which often focuses on regulating resources, yields mitigated results in terms of environmental management (Ostrom, 1990), the performance of decentralization policies concerning natural resources management by user communities has also been called into question by Baland and Platteau, 1996 while local user organizations were often able to develop complex mechanisms for allocating and distributing products from these resources, they often seemed to be inadequate when it came to setting up systems to protect such

resources. This was particularly true when market expansion and population pressures come into play. Mansur and Rao, 2004 also criticized the community participation programmes because of absence of accountability and monitoring procedures in these programmes.

1.3 Objectives of the Study

The objectives of the study were as follows:

1. To examine the status of India's environment with special reference to air, water and land resources.
2. To examine the status of forests in India.
3. To examine the policies and programmes initiated for environment and forest management in India.
4. To examine people's role in management of forests.

1.4 Methodology and Database

The study is a descriptive analysis entirely based on secondary data sources including published government data. The data on land use pattern was obtained from Agriculture Statistics of Ministry of Agriculture. Air and water quality trends were analyzed from the data of Central Pollution Control Board. The data on urbanization was taken from various Census of India. The state-wise data on access to safe drinking water in India was collected from various Economic Surveys of India. Moreover, the data for analyzing the trend of forest cover in India was compiled from Forest Survey of India's (FSI) State of Forest Reports.

1.5 Limitations of the Study

The study is confined to the descriptive analysis of environment and forest degradation due to non-availability of systematic and time-series data on various environmental components such as air, water and forests. The trend in forest cover was analyzed by using biennial data of Forest Survey of India. However, the actual change in forest cover could not be assessed due to lack of separate data on natural forests and tree plantations. Moreover, lack of strictly comparable data on forest cover due to methodological and technological changes between the two years was a major limitation. Apart from these, the real contribution of forests to country's GDP could not be identified due to lack of data on intangible benefits of forests as well as due to non-recording of unauthorized extraction from forests.

1.6 Scheme of the Study

The thesis is organized into seven chapters.

Chapter 1 is a general introduction to the study which states the relevance and need of the study in Indian context, provides historical perspective and review of related literature, and outlines the objectives, methodology and database used as well as the limitations encountered during the course of the study.

Chapter 2 deals with the status and trends of India are environment with special reference to land, air and water resources and discusses the environmental problems associated with these resources.

Chapter 3 deals with the status and trends of forests in India and discusses the issues concerned with this resource.

Chapter 4 examines the effectiveness of various policies and programs initiated in India's Five Year Plans for the management of environment and forests in the country.

Chapter 5 reviews various Constitutional, legislative as well as administrative arrangements made for the environment and forest management in India and also discusses their effectiveness.

Chapter 6 examines the role of local communities in environment and forest protection in India and discusses various observations on the effectiveness and outcome of the movements.

Chapter 7 gives a summary of the major findings and the conclusion of the study.

Chapter - 2

Status of Environment in India

STATUS OF ENVIRONMENT IN INDIA

India is confronted with rapid degradation of the environment on account of various environmental problems like land/soil degradation, loss of farming capacity, forest degradation, loss of biodiversity, air and water pollution, pesticide pollution, climate change, etc. This is the outcome of increasing population density, industrialization, urbanization and poor environmental management practices. Since India's independence, there has been a massive increase in population in the country. The increasing demand for food and shelter has exerted greater pressure on the available natural resources. For raising the agricultural productivity, more and more amount of land was brought under cultivation. This has reduced forest area and also pasture and fallow land. Besides, the indiscriminate use of fertilizers and irrigation for intensive cultivation resulted in soil salinity and alkalinity thereby converting the arable land into wasteland. In addition to these, the technological innovations have induced rapid industrialization and subsequent urbanization. These innovations have contributed to the growth of the economy at large. But at the same time, they have created a serious threat to the environment by posing various environmental problems like emission of toxic gases, depletion of ozone layer, acid rain, pollution of air, water, soil, etc. The tremendous increase in the demand for wood for various purposes, ranging from domestic to industrial consumption has led to large scale deforestation during the last few decades. The area under forest has declined at an alarming rate which has resulted in land erosion, flooding of rivers and siltation of water bodies.

2.1 Land

Land, a non-renewable natural resource is central to all primary production systems, and thus assumes special importance for promoting not only economic well-

being but also socio-cultural identity in an agrarian economy like India (Chopra, 1989). Various theories, mainly from neo-classical economic literature uphold the importance of land in determining the pace as well as composition of economic growth over different stages. For example- David Ricardo pointed towards the limited availability of good quality of land as a factor leading to diminishing returns to land (Shah, 2009).

2.1.1 Land use Pattern in India 1950-51 to 2007-08

The physical, economic and institutional framework taken together determines the pattern of land-use of a country at any particular time. The Technical Committee on Coordination of Agricultural Statistics, set up in 1948 by the Ministry of Food and Agriculture, recommended a nine-fold land use classification for India (Mohanty, 2008).

The classification of land-use in India from 1950-51 to 2007-08 is given in Table 2.1. The land use pattern in the country has undergone drastic changes over the last five and a half decades (from 1951 to 2007-08). Out of the total geographical area of 328 million hectares (mha), the land use statistics were available for roughly 284 mha in 1950-51, however in 2007-08, the reporting area has increased to around 306 mha. The area, for which data on land use classification are available, is known as the reporting area. Area under forests includes all lands classed as forests under any legal enactment dealing with forests or administered as forests, whether state-owned or private, and whether wooded or maintained as potential forest land (Mohanty, 2008). According to Table 2.1 there has been perceptible increase in the forest area from 40.48 mha (14.24%) in 1950-51 to 68.31 mha (22.34%) in 2007-08. However, this is not suggestive of a real increase in area under forest but is due to incremental increase in reporting area (Chadha, *et al.*, 2004). The area under barren and uncultivable land

is generally unsuitable for agriculture either because of topography or its inaccessibility. The area, however, decreased from 38.16 mha in 1950-51 to 17.59 mha in 2000-01 but remained almost stable at 17.5 mha between 2001-02 and 2007-08. The area under non-agricultural use includes all lands occupied by buildings, roads, railways or under water, e.g. rivers, canals and land put to other than agricultural use. Recently, the area under non-agricultural land increased due to increase in developmental activities, e.g. housing, transport system, irrigation, etc. Land put to non-agricultural uses increased by 16.56 mha during the reference period. The increase may be attributed to rise in human population and launching of development programmes/ projects for boosting the economy of the country as well as urbanization (Chadha, *et al.*, 2004).

Table 2.1- Land Use Pattern in India (1950-51 to 2007-08)

(In million hectares)

Classification	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2007-08 (P)
I. Geographical Area	328.73	328.73	328.73	328.73	328.73	328.73	328.73
II. Reporting Area for Land Utilization Statistics (1 to 5)	284.32	298.46	303.75	304.16	304.86	305.18	305.67
1. Forests	40.48	54.05	63.83	67.46	67.81	69.53	68.31
2. Not Available for Cultivation (a+b)	47.52	50.75	44.61	39.55	40.48	41.48	43.22
(a) Non Agricultural Uses	9.36	14.84	16.48	19.60	21.09	23.89	25.92
(b) Barren and Unculturable Land	38.16	35.91	28.13	19.96	19.39	17.59	17.29
3. Other Uncultivated Land excluding fallow land (a+b+c)	49.45	37.64	35.13	32.31	30.22	27.74	26.82
(a) Permanent Pastures and Other Grazing Land	6.68	13.97	13.26	11.99	11.40	10.67	10.39
(b) Land under Miscellaneous Tree Crops and Groves not Included in Net Area Sown	19.83	4.46	4.37	3.58	3.82	3.44	3.31
(c) Culturable Wasteland	22.94	19.21	17.50	16.74	15.00	13.63	13.12
4. Fallow Lands (a+b)	28.12	22.82	19.33	24.55	23.37	25.07	25.15
(a) Fallow Lands other than Current Fallows	17.45	11.18	8.73	9.72	9.66	10.29	10.34
(b) Current Fallows	10.68	11.64	10.60	14.83	13.70	14.78	14.81
5. Net Area Sown (6-7)	118.75	133.20	140.86	140.29	143.00	141.36	140.86
6. Gross Cropped Area	131.89	152.77	165.79	172.63	185.74	185.34	195.83
7. Area Sown More Than Once	13.15	19.57	25.52	32.63	42.74	43.98	54.97
8.Cropping Intensity*	111.1	114.7	117.7	123.1	129.9	131.1	139.1
III. Net Irrigated Area	20.85	24.66	31.10	38.72	48.02	55.13	62.29
IV. Gross Irrigated Area	22.56	27.98	38.20	49.78	63.20	76.19	87.26

Source: Agriculture Statistics at a Glance 2008, Ministry of Agriculture, Government of India.
P: Provisional
* Cropping intensity is obtained by dividing the gross cropped area by the net area sown

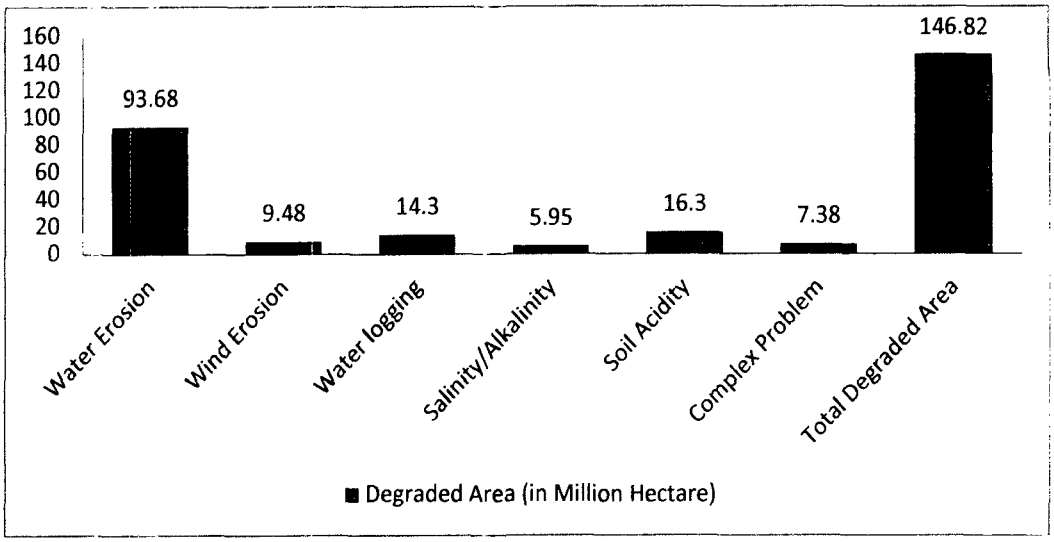
The net sown area increased from 118.75 mha in 1950-51 to 140.86 mha in 1970-71. Most of this expansion has taken place through diversion of forest and grazing land to agriculture. Since 1970-71, however, the net sown area has remained almost the same at around 142 mha levels. Cropping intensity has increased from 111.1 mha in 1950-51 to 139.0 in 2007-08. The increase in cropping intensity shows the increase in intensive use of agricultural land in India. This increasing intensive use of agricultural land to meet the food demand of growing population by using modern technology has led to increase in salinity of soil in India. Moreover, large tracts of fertile agriculture and forest land have been diverted for urbanization and settlements. Deforestation contributes to loss of precious top soil which amounts to about 35 percent of the global sediment load going to oceans even though water flowing through the rivers in India is only about five percent of the flow of rivers in the world (CSO, 2010).

2.1.2 Land Degradation in India

Land degradation refers to "a temporary or permanent decline in the productive capacity of the land" (Scherr and Yadav, 1996). Over the years, the country's land mass has suffered from different types of degradation caused by biotic and abiotic factors. An ever increasing population places enormous demand on land resources. This is particularly acute in India which has only 2.4% of the world's geographical area but supports over 16.7 percent of the entire global population. Further, the country has 0.5 percent of the world's grazing lands but has over 18 percent of the world's cattle population. These pressures have led to drastic changes in the proportion of land utilized for agricultural activities, urbanization and industrial development (The Tenth Five Year Plan, 2002-07).

A study conducted by the National Bureau of Soil Survey and Land Use Planning revealed that 44.7% of total geographical area (around 146.82 mha) was under various stages of degradation. While 93.68 mha (28.5%) of land is water eroded, 9.48 mha (2.9%) is affected by wind erosion and 14.3 mha (4.35%) is degraded due to water logging. Besides, 5.95 mha (1.8%) is degraded due to salinity/alkalinity, 16.03 mha (4.9%) from soil acidity and 7.38 mha (2.24%) from other complex problems (Figure 2.1).

Figure: 2.1 Extent of land degraded under various categories in India in 2005



Source: National Bureau of Soil Survey and Land Use Planning, 2005

The extent of degradation is the outcome of inappropriate management practices. While on one hand, it is unsustainable biotic factors (like fuel wood and fodder extraction, encroachment on forests, grazing, forest fires, etc. which lead to land degradation, on the other hand, some other factors such as extension of cultivation to non-arable lands, lack of appropriate soil conservation measures, indiscriminate use of chemicals in agriculture, inappropriate irrigation systems, etc., which are responsible for land degradation in India. Moreover, indirect pressures such as land shortage, short-term or insecure land tenancy, open access resource, economic

status and poverty of the agriculture dependent people, which are also instrumental to a significant extent for the degradation of land (MoEF, 2009a).

2.1.3 Factors Responsible for Land Degradation

Agricultural Practices

Since independence, Indian agriculture has undergone technological, structural and institutional transformation. The total area of land under cultivation (net-sown area) has increased from 118.75 mha in 1950-51 to 140.86 mha in 2007-08. Most of this expansion has taken place at the expense of forests and grazing land. Cropping intensity has increased from 111.1 mha in 1950-51 to 139.0 mha in 2007-08. Net irrigated area also witnessed a three-fold increase from 20.85 mha in 1950-51 to 62.29 mha in 2007-08.

With the introduction of Green Revolution in the country in mid 1960's, a technology oriented investment growth in agriculture led the farmers to over-exploit the fixed resources and to over use the new inputs particularly chemical fertilizers and pesticides since these inputs bring about a cumulative positive impact on yield rates of various crops as well as on total agricultural production (Mohapatra, 2003).

Shifting Cultivation

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, and then abandoned. It is an unscientific form of land use, currently prevalent in north eastern regions of India. It has been a major factor responsible for land degradation in these areas. With the increase in human population and increasing pressure on land, the earlier 15-20 years cycle of shifting cultivation on a particular land has reduced to 2-3 years now. This has resulted in large scale deforestation, soil and nutrient loss and invasion by weeds and other species. The

indigenous biodiversity has been adversely affected to a large extent (Ninan, 1992). Since, shifting cultivation leads to drying up of springs in the hills, soil erosion, destroys valuable forests and deprives people from the benefits of the forest produce, it is argued that this ruinous and wasteful method of cultivation must be abandoned for the benefit of the people (Ranjan and Upadhyay, 1999).

Most of north-east forests in India are under tremendous pressure of exploitation due to unplanned traditional forestry practices, especially widespread use of slash and burn shifting cultivation, in which native people clear and burn the old forest growth on a piece of land to get fertile land for raising agricultural crops for one or two years and then move on to clear fresh forest land. In fact, the major stressor to native forest biodiversity is the increasing anthropogenic conversion of mature and primary forests to *jhum* land (Kumar, 2006).

Indiscriminate Use of Agro-Chemicals

The indiscriminate use of agro-chemicals, such as fertilizers and pesticides has also been responsible for land degradation. In India, Green Revolution has brought about technological breakthrough, which led to the use of High-Yielding Varieties (HYVs), leading to intensive use of land, increasing the area brought under irrigation and excessive use of chemicals such as fertilizers and pesticides. Due to heavy use of fertilizers, excess nitrates leach into groundwater which causes contamination of groundwater (Shetty, 2004). Thus, the efforts to raise agricultural output have resulted in land and water degradation by limiting future gains from these resources.

While in 1951-52, the per hectare consumption of fertilizers was merely 0.6 kg, it increased to 20 kg in 1976-77, 69.8 kg in 1991-92 to 113.3 kg in 2006-07 (GOI, 2006). There is excessive use of urea and a bias against micronutrients. As against the

desirable Nitrogen, Phosphorous and Potassium (NPK) proportion of 4:2:1, the average use of urea with P and K are in the proportion 6:2 and 4:1 respectively. This excessive use of urea has adversely affected the soil fertility (MoEF, 2009a).

Soil Erosion

As soil is a non-renewable natural resource which supports life on earth, its erosion is a serious problem that leads to loss of fertile top soil, siltation of reservoirs, and even disasters like landslips. It is estimated that one-sixth of the world's soil has already been degraded by water and wind erosion. In developing countries, 6 to 7 mha of agricultural land become unproductive every year due to soil erosion and another 1.5 mha due to other reasons. In India, erosion rates range from 5 to 20 tonnes per hectare, sometimes going up to 100 tonnes per hectare. Nearly 93.68 mha are affected by water erosion and another 9.48 mha are affected by wind erosion annually in India. Thus, erosion leads to impoverished soil on one hand and silting up of reservoirs and water tanks on the other (MoEF, 2009a). While soil erosion by rain and river-water in hilly areas causes landslides and floods, some anthropogenic factors such as deforestation, overgrazing, traditional agricultural practices, mining and incorrect sitting of development projects in forested areas have also been responsible for severe soil erosion (Mohapatra, 2003).

Mining

India is rich in a variety of natural resources. Along with 56% arable land, it has a number of sources of coal, iron ore, manganese, mica, bauxite, titanium ore, chromites, natural gas, diamonds, petroleum and limestone (GOI, 2010).

Land degradation is considered to be an unavoidable by-product of mining and has reached alarming proportions, mainly due to over-exploitation and

mismanagement of natural resources. Impact of mining on land gets reflected in land use pattern of the respective area because more the land gets exposed to erosion by losing its green cover or by getting disturbed otherwise due to mining (excavation, overburden & dumping) and related activities, its water resources get damaged, soils get contaminated, part or total of flora and fauna gets lost, air and water gets polluted and as rate of damage accelerates, the cumulative effects push the land towards degradation (Sahu and Dash, 2011). Mineral production generates enormous quantities of waste overburden as can be seen for some minerals (Table 2.2). The details have been worked out with the help of actual production figures and the projections made in terms of overburden/waste. Actual data was not available on the extent of land occupied by mining operations including waste disposal sites. It is, however, estimated that about 13,546 hectares of land was affected in 2005-06 (Table 2.2).

Table: 2.2 Mineral production, Waste generation and Land affected in 2005-06

Mineral	Production (in million tonnes)	Overburden/Waste generation (in million tonnes)	Estimated land affected (in hectares)	Norms used (land in hectare/million tonnes of coal/ore)
Coal	407.00	1493.00	10175	25
Limestone	170.38	178.30	1704	10
Bauxite	12.34	7.50	123	10
Iron ore	154.40	143.90	1544	10
Others	9.44	18.61	NA	NA

Source: 1. Indian Bureau of Mines, 2006.
2. Tata Energy Research Institute (TERI), 2001
NA- Not Available

Low Forest Cover

Forests bear a pivotal role in protecting the quality of all aspects of environment, also in many cases they are considered as a desired indicator of environmental quality. Forests provide a wide range of services which include

prevention of soil erosion, floods, landslides, maintenance of soil fertility and fixing carbon from the atmosphere as biomass and soil-organic carbon. However, according to 2011 assessment by Forest Survey of India, total forest cover of India is 692,027 square km, constitutes only 21.05% of land area of the country (FSI, 2011) and is way below the stipulated target of 33% of geographical area, fixed by the National Forest Policy of 1988.

2.2 Air

The only reason earth can sustain life is because of its atmosphere. A number of different gases, including oxygen, make up the earth's atmosphere in a mixture that keeps plants, animals and people alive. In addition to sustaining life, air plays a role in many other important functions that are best performed when air quality is high. However, in recent years, the air quality in India has shown a deteriorating trend due to a number of factors such as urbanization, increase in number of vehicles, increase in industrial activity, etc. Thus, the maintenance and improvement of air quality is a major environmental challenge in the backdrop of various developmental activities.

2.2.1 Air Pollution

The World Health Organization (WHO) defines air pollution as "substances put into the air by the activity of mankind into concentrations sufficient to cause harmful effects to health, property, crop yield or to interfere with the enjoyment of property" (Nagdeve, 2002). Some of the most important air pollutants are Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_2), Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Carbon Monoxide (CO), lead (Pb), etc. According to WHO (2005), about 4-8 percent of deaths in the world were related to air pollution. An estimate by the World Resource Institute (1999) revealed that nearly

1.4 billion urban residents in the world breathe air, exceeding the WHO air quality guidelines (cited in CPCB, 2001).

Air pollution has become an issue of concern in India on account of ongoing population explosion, urbanization and industrialization. These factors have placed significant pressure on the country's infrastructure and natural resources. While industrial development has contributed significantly to economic growth, it has done so at considerable cost to the environment in the form of toxic emissions, ozone layer depletion, acid rain and pollution of air, water and land surface. The air quality has been, therefore, an issue of social concern in the backdrop of various developmental activities. According to reports, India's urban air quality ranks amongst worst in the world. Of the three million premature deaths in the world that occur each year due to outdoor and indoor air pollution, the highest numbers occur in India. However, some cities in India have recently witnessed a decline in air pollution levels due to various measures taken by the Government. According to a World Bank study, there was a decline in premature deaths (by about 13,000) in several major cities viz. Delhi, Mumbai, Kolkata, Ahmedabad and Hyderabad (MoEF, 2009a).

2.2.2 Air Quality Trends

Central Pollution Control Board (CPCB) executes a nation-wide programme of ambient air quality monitoring with the help of State Pollution Control Boards (SPCB) known as National Air Quality Monitoring Programme (NAMP). The network consists of 346 monitoring stations covering 130 cities/towns in 26 States and 4 Union Territories of the country. The parameters are Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_2) and Particulate Matter- Respirable Suspended Particulate Matter (RSPM) and Suspended Particulate Matter (SPM). A comparison between the

air qualities of different cities/towns has been compared with the respective National Ambient Air Quality Standard (NAAQS), is given in Appendix I. The number of stations violating annual standards and 24-hourly NAAQS during the year 2007 is shown in Table 2.3.

Table 2.3 Number of Monitoring Stations Violating NAAQS in 2007

Area Class	SO_2		NO_2		SPM		RSPM	
	24-Hourly	Annual	24-Hourly	Annual	24-Hourly	Annual	24-Hourly	Annual
Residential	NV	NV	14	7	154	132	160	157
Industrial	NV	NV	5	1	32	18	76	44
Sensitive	1	NV	8	10	12	13	12	11
Total	1	NV	27	18	198	163	248	212

Source: Central Pollution Control Board, 2008
Note: NAAQS- National Ambient Air Quality Standard; SO_2- Sulphur dioxide; NO_2- Oxides of Nitrogen; RSPM- Respirable Suspended Particulate Matter; SPM- Suspended Particulate Matter; NV- No Violation.

It is evident from table 2.3 that there was no violation of NAAQS (Annual average and 24 hourly averages) of SO_2 at any monitoring stations in residential and industrial areas. NAAQS (Annual average) of NO_2 was violated at 18 monitoring stations and NAAQS (24 hourly average) of NO_2 was violated at 27 monitoring stations. However, NAAQS of SPM and RSPM are violated at most of the monitoring stations. NAAQS (Annual average) of SPM was violated at 132 monitoring stations in residential areas and at 18 monitoring stations in industrial areas. Similarly, NAAQS (Annual average) of RSPM was violated at 157 monitoring stations in residential areas and at 44 monitoring stations in industrial areas. The major sources of air pollution in most of the stations where NAAQS is violated in terms of RSPM and SPM are motor vehicles, industries, power plants and biomass burning used for captive power generation (CSO, 2007).

2.2.3 Factors Affecting Air Quality

Increase in Urban Population

India is the second most populous country in the world after China. It supports 16.87% of the world's population on 2.4% of global land area. The country has witnessed an explosive growth of population from 342 million in 1951 to around 1027 million in 2001 and to about 1210 million in 2011. In the same manner, the urban population has increased from 62.4 million in 1951 to 288 million in 2001. The number of towns (areas more than 20,000 inhabitants have been classified as town) has also increased from 3060 in 1951 to 5161 in 2001 (Table 2.4).

Table: 2.4 Patterns and Trend of Urbanization in India 1951-2001

Census Years	Number of Towns[1]	Urban Population (In million)	Percentage of Urban Population to total population	Rate of Urbanization[2] (AAGR)
1951	3060	62.4	17.3	-
1961	2700	78.9	18.0	0.40
1971	3126	109.1	19.9	1.06
1981	4029	159.5	23.3	1.72
1991	4689	217.6	25.7	1.02
2001	5161	284.5(P)	27.8	0.82

Source: Census of India, 2001
Excluding Assam in 1981 and Jammu and Kashmir in 1991, (P)- Provisional figures
Notes: 1. Constituents of cities and towns of urban agglomerations have been counted as separate units.
2. Rate of urbanization has been calculated by Average Annual Growth Rate (AAGR)

The population growth has mainly centered on cities due to large scale migration of rural population in search of livelihoods. According to Bose (2007), the population of India's largest city (Delhi) is expected to grow 1.9 times, i.e. almost double from 1997 to 2020. Moreover, high population growth rates especially in Indo-Gangetic (IG) basin have resulted in unbalanced human concentration. The result is that IG basin is one of the most densely populated regions in the world. This rapidly expanding population, especially in urban areas, has led to rapid industrialization which has created tremendous pressure on environment (Goyal *et al.*, 2005).

Pollution from Vehicles

Air pollution due to vehicular emission is one of the most critical issues in urban areas. Kathuria (2005) has pointed out that mobile or vehicular pollution predominantly contributes to overall air quality problem in urban areas of both developed and developing countries. The contribution of vehicular pollution to overall ambient air quality in India is about 65-70% (CSO, 2010). In Delhi alone, two-third (66%) of the total 3,000 metric tonnes of pollutants belched out every day, are from vehicles. Similarly, the contribution of vehicles to urban air pollution is 52% in Bombay and 33 % in Kolkata. The pollution problem in urban cities due to vehicular emission may continue to increase in future due to ever-burgeoning vehicular population along with the other motorized forms of transportation (taxis, autos, trains, buses, etc.).

The Transport Research Wing of the Ministry of Road Transport and Highways has estimated that the total number of registered motor vehicles in India has increased from 3 million in 1950-51 to more than 33 million in 1995-96 and further to 89 million in 2005-06. Similarly in Delhi, against 1.9 million vehicular populations in 1990, it rose to nearly 3.6 million in the year 2001 (i.e. an increase of nearly 87%). However, during the same period, Delhi's population increased by only 43% (from 9.5 million to 13.8 million) and road length by merely 14% (from 22,000 km to 25,000 km) respectively. Situation is similar across a number of cities in India and the developing world (Kathuria, 2005). Apart from the concentration of vehicles in urban areas, other reasons for increasing vehicular pollution are the types of engines used, age of vehicles, heavy traffic, poor road conditions, outdated automotive technologies and traffic management system (GOI, 2007). The pollution from vehicles are due to discharges like Carbon Monoxide (CO), Oxides of Nitrogen

(NOX), Unburned Hydrocarbons (HC), Suspended Particulate Matter (SPM) and lead compounds, etc. The worst thing about vehicular pollution is that it cannot be avoided as the emissions are emitted at the near ground level where we breathe. Pollution from vehicles gets reflected in increased mortality and morbidity as is revealed through symptoms like cough, headache, nausea, irritation of eyes and various bronchial problems. This indicates the exigency of controlling vehicular pollution (Cropper, 1997).

Increase in Industrial Activity

Growth of India's economy is led by a robust performance of the industrial sector. The development of a diversified industrial structure, based on a combination of large and small-scale industries, along with growing population has contributed to the growing incidence of air pollution. Impressive growth in manufacturing (7.4 percent average over the past ten years) is a reflection of growth trends in the fields of electronics and information technology, textiles, pharmaceuticals, basic chemicals etc. These industries have significant environmental consequences in terms of air emissions. The economic boom has also led to an increase in investments and activities in the construction, mining, iron and steel sectors. This, in turn, is causing a significant increase in brick making units, sponge iron plants and steel re-rolling mills that involve highly polluting processes (GOI, 2007).

Air borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms, viz. solid particles (SPM) and gaseous emissions (SO_2, NO_2, CO, etc.). These gases not only pollute air but also consume oxygen available in the air. Other specific pollutants arise from particular sources e.g., urea dust from fertilizer factories, lead from automobile emission, fluorides from

aluminum production, cement and lime dust from cement factories, radiation from nuclear power stations, etc.

Table: 2.5 Status of Pollution Control in Grossly Polluting Industries in India in 2010

Industrial Category	Complying[1]	Defaulting	Closed	Total
Aluminium	8	0	0	8
Cement	175	22	80	277
Chlor-Alkali	27	1	4	32
Copper	5	0	0	5
Distillery	174	29	34	239
Dies & Intermediates	62	3	30	95
Fertilizer	79	7	35	121
Iron & Steel	56	3	10	69
Oil Refineries	18	2	9	21
Pesticides	19	0	3	22
Petrochemicals	44	1	11	56
Pharmaceuticals	291	32	75	391
Pulp & Paper	104	33	47	184
Sugar	377	69	66	512
Tannery	103	8	38	149
Thermal Power	198	27	19	244
Zinc	6	0	0	6
Total	1791	253	478	2522

Source: Central Pollution Control Board, Ministry of Environment and Forests, 2010
[1] Having adequate facilities to comply with the standards.

In India, 17 categories of highly polluting industries have been identified for the purpose of monitoring and regulating pollution from them. The Ministry of Environment and Forests (MoEF) has developed standards for regulating emissions for various industries including thermal power stations, iron and steel plants, cement plants, fertilizer plants, oil refineries, pulp and paper, petrochemicals, sugar, distilleries and tanneries. The status of pollution control in medium and large-scale units of 17 categories of polluting industries in June 2010 is as follows: out of total 2,522 industries, 1791 have so far been provided the necessary pollution control facilities, 478 have been closed down and the remaining 253 industries are defaulters (Table 2.5).

The data reveals that nearly 10 percent of the total industries among 17 categories of total industries are found defaulting with respect to pollution control.

Most of these industrial units are located in the states of Maharashtra, Gujarat, Bihar, Madhya Pradesh, Uttar Pradesh and West Bengal. The highest concentration of sulphur dioxide and oxides of nitrogen is, therefore, often found in cities located in these states. Some other industrial states like Delhi, Punjab, Rajasthan and Andhra Pradesh are also becoming critical (CSO, 2010).

Air Pollution from Power Sector

The electricity generation capacity in India has increased from a meager 1,713 Megawatt (MW) in 1950 to 1,43,061 MW in 2008 (Appendix II). The generating capacity in India comprises a mix of hydro, thermal and nuclear plants. Since the early seventies, the hydro-thermal capacity mix has changed significantly with the share of hydro in total capacity declining from 42 percent in 1970 to 25 percent in 2008. While during the same period, the share of thermal in total capacity has increased from 54 percent to 64 percent. However, the country's increasing reliance on this source of energy leads to many environmental problems.

The consumption of coal is a dominant factor in India's energy sector on account of its higher availability than other sources of energy (CMIE, 2005). It meets about 51 percent of the country's commercial energy needs. The power sector is a major consumer of coal, using about 78 percent of the country's coal production. Coal-fired thermal units account for around 62.2 percent of total power generation in the country. India's heavy reliance on coal explains the country's relatively high carbon intensity level. Coal production through opencast mining, its supply to and consumption in power stations and industrial boilers leads to particulate and gaseous pollution. Apart from these, radioactive emissions from nuclear power plants are of grave concern as they can cause serious impact both in terms of spatial and inter-generational effects (MoEF, 2009a).

In 2006-07, India had endured 495.54 million tonne of total absolute emissions of CO_2 from the power sector (Table 2.6). With high capital costs associated with replacing existing coal-fired plants and the long time required to introduce advanced coal technologies, many of India's highly polluting coal-fired power plants are expected to remain in operation for the next couple of decades, thereby keeping India's carbon emissions on the rise. However, the contribution of India to the cumulative global CO_2 emissions is only 5 percent. Thus, India's share in the carbon stock in the atmosphere is very small when compared to its population (MoEF, 2009 a).

Table: 2.6 Total Absolute Emissions of CO_2 from the Power Sector by Region (2000-01 to 2008-09)

Region	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	97.87	102.74	106.81	110.00	112.21	120.10	129.55
East	58.03	61.43	66.59	75.51	83.96	92.52	93.36
South	89.02	92.18	105.24	108.12	105.60	101.76	109.25
West	135.19	141.60	148.56	144.13	157.78	153.93	157.72
North-East	2.21	2.16	2.29	2.46	2.47	2.53	2.65
India	**382.31**	**4000.11**	**429.48**	**440.22**	**462.02**	**470.85**	**495.54**

Source: Compendium of Environmental Statistics- India, 2007

Indoor Air Pollution

Indoor air pollutants associated with the combustion of solid fuels in households of developing countries are now recognized as a major source of health risks to the exposed populations. Use of open fires with simple solid fuels, biomass or coal for cooking and heating exposes an estimated 2 billion people worldwide to concentrations of particulate matter and gases that are 10 to 20 times higher than prescribed health guidelines for typical urban outdoor concentrations. Since nearly half of the world's population cooks and heats their homes with biomass fuels on a

daily basis, indoor exposures are likely to exceed outdoor exposures to some major pollutants on a global scale (Balakrishnan, 2004).

The use of traditional biomass fuels-wood, dung and crop residues is also widespread in rural India. According to the National Family Health Survey-3 (NFHS-3), more than 60 percent of Indian households depend on these traditional sources of energy for meeting their cooking and heating needs (Table 2.7).

Table: 2.7 Proportions of Households by Type of Fuel Use

(in percent)

Type of Fuel	NFHS-1 (1992-93)	NFHS-2 (1998-99)	NFHS-3 (2005-06)
LPG	11	17	25
Kerosene	8	8	3
Coal	4	3	2
Wood	64	59	49
Dung Cakes	10	7	11
Others	3	6	10
Total	**100**	**100**	**100**

Source: National Family Health Survey-3, 2005-06
NFHS- National Family Health Survey.
LPG- Liquefied Petroleum Gas

The stoves or *chullahs* used for cooking are not energy efficient. The fuels are not burned completely. This incomplete combustion of biomass releases complex mixture of organic compounds, which include SPM, carbon-monoxide, poly organic material (POM), poly aromatic hydrocarbons (PAH), etc. The biomass may also contain intrinsic contaminants such as sulphur, trace metals, etc. (ICMR, 2001). Along with severe ecological problems, the emission of these pollutants is associated with serious respiratory and other adverse health effects like cancer risk, respiratory diseases, tuberculosis, bronchitis, etc (Nagdeve, 2002). A report of the World Health Organization (WHO) asserts that a pollutant released indoors is one thousand times more likely to reach people's lungs than a pollutant released outdoors (WHO, 1997). It has been estimated that indoor air pollution claims a shocking 5 lakh lives in India, every year, most of whom are women and children (Sinha, 2007).

2.3 Water

Water is a finite but renewable natural resource and like other natural resources, it is an integral part of the environment. It is essential for survival of all living beings on the earth and also for socio-economic development of households, communities and nations all over the world. Besides, it is also necessary for maintaining and enhancing biodiversity and quality of the environment (Singh, 2009). Thus, easy access to water is a critical component in determining the quality of human life in a country. Unfortunately, the availability of usable freshwater is very limited. According to CSE (2004a), roughly 70 percent of the earth is covered with water, however, 97.5 percent of it is saltwater. Only 2.5 percent of the earth's water is fresh and much of that is frozen. Just 0.5 percent of the world's water is accessible fresh water.

2.3.1 Water Resources in India

India, as a whole, is reasonably well endowed with fresh water resources. It receives nearly 4000 billion cubic meters (BCM) of fresh water annually through rainfall and snowfall (Table 2.8). It is estimated that India accounts for about 4 percent of the world's freshwater resources. However, this seems inadequate when we consider India's share in total human (17 %) and livestock (18 %) populations of the world. The picture looks bleak when we look at the per capita availability of renewable fresh water resources, which has declined from 1816 m^3 in 2001 to 1588 m^3 in 2010 (CSO, 2010).

Surface Water

India is rich in terms of surface water resources. Average annual precipitation is 4000 cubic km. After accounting for percolation, evaporation and other losses, less

than 50 percent (1,869 BCM) is the total surface flow. In view of the constraints of topography, uneven distribution over space and time, water shortage technologies and inter-state issues, the quantum of surface water is only about 690 cubic km, out of total utilizable quantity of 1123 BCM per year (Table 2.10). However, conditions vary widely from region to region. Whereas some regions are drought affected, others are frequently flooded. This causes enormous economic loss to the nation and sufferings to the millions of affected people (CSO, 2010).

Ground Water

Groundwater is the most important source of water in India. The total annual replenishable groundwater potential of the country has been estimated by the Ministry of Water Resources as 433 BCM. Groundwater occupies an important position not only for agriculture, but also from the point of view of the economy as a whole. The potential available for irrigation is 360 BCM (83 %) per year and remaining 73 BCM (17%) is for drinking, industrial and for other purposes. The figure for net draft of groundwater considering the present utilization indicates that substantial portion of total potential (about 68 percent) is still remaining untapped (GOI, 2009).

Table: 2.8 Water Availability in India

S. No	Items	Quantity
1	Annual Precipitation (including snowfall)	4000 BCM
2	Average Annual Availability	1869 BCM
3	(i) Per Capita Water Availability (2001)	1816 Cubic M
4	Estimated Utilizable Water Resources	1123 BCM
	(i) Surface Water Resources	690 BCM
	(ii) Ground Water Resources	433 BCM

Source: Ministry of Water Resources, 2006
BCM Billion Cubic Meter.

Water resources in India are under great biotic and abiotic pressures. Most of the rivers, lakes, tanks and ponds are polluted and the groundwater aquifers are being over-exploited in most of the arid and semi-arid regions and are on the verge of complete exhaustion/depletion (Singh & Shishodia, 2007). Besides, in many areas, the groundwater aquifers have been polluted /contaminated. All these factors together have adversely affected the quality of the environment.

2.3.2 Water Demand and Usage

Rise in demand and development pressures are changing the scenario of water availability in India. While groundwater reserves are becoming more and more depleted, surface water sources have become too polluted for human use. The agricultural, industrial and domestic sectors are competing more and more for a limited water supply. The agricultural sector continues to dominate water use owing to its continued importance to the Indian economy; industrial demands are also increasing with the growth of the industrial sector. However, domestic needs claim only a small portion of the annual water withdrawals as access to adequate water and sanitation supplies remains low throughout the country.

Domestic Demand

Demand from the domestic sector has remained low and accounts for only 5 percent of the annual freshwater withdrawals in India (World Resources Institute WRI, 2000). About 7 km^3 of surface water and 18 km^3 of groundwater are being used as domestic water supply in urban and rural areas. However, with the increase in population and corresponding increase in urbanization, domestic water use is also expected to increase in future. It is projected that by the year 2050, nearly 61 percent of population will be living in urban areas in high-growth scenario as against 48

percent in low-growth scenario. By the same period, water requirements per year for domestic use will be 90 km^3 for low demand scenario and 111 km^3 for high demand scenario (MoWR, 1999). It is expected that about 70 percent of urban water requirement and 30 percent of rural water requirement will be met by surface water sources and the remaining from groundwater (Kumar *et al.*, 2005).

Agricultural Demand

Traditionally, India has been an agriculture based economy. Hence, development of irrigation to increase agricultural production for making the country self-sustained and for alleviation of poverty has been of crucial importance for planners. Accordingly, the irrigation sector was assigned a very high priority in the Five-Year Plans. A number of river-valley schemes, like Bhakra-Nangal, Hirakund, Damodar Valley, Rajasthan Canal Project, etc. were taken up to increase irrigation potential and maximize agricultural production (Kumar *et al.*, 2005). As a result, there was incredible growth in crop production. The increase in production has also contributed greatly to India's economy and food security. However, irrigation expansion has also placed greater demands on surface and groundwater resources in the country. According to the Union Ministry of Water Resources (MoWR), 80 percent of India's utilizable water is devoted to agriculture sector, mostly in the form of irrigation. Requirement is likely to increase in future as agriculture is extremely dependent on adequate freshwater supply. An estimate by the National Commission on Integrated Water Resources Development (NCIWRD) has indicated that by the year 2025, the water requirement for irrigation would be 561 BCM for low demand scenario and 611 BCM for high demand scenario. These requirements are likely to increase further to 628 BCM for low demand scenario and 807 BCM for high demand scenario by 2050. On the other hand, the Standing Sub Committee of the Ministry of

Water Resources has predicted that the water demand for irrigation would be 910 BCM by the year 2025, which is likely to increase to 1072 BCM by the year 2050 (Table 2.9). Thus, the extraction of water by agriculture sector is expected to increase in future.

Table: 2.9 Projected Water Demand in India

Sector	Water Demand (In BCM)								
	MoWR Estimates			NCIWRD Estimates					
	2010	2025	2050	2010		2025		2050	
				Low	High	Low	High	Low	High
Irrigation	688	910	1072	543	557	561	611	628	807
Domestic	56	73	102	42	43	55	62	90	111
Industry	12	23	63	37	37	67	67	81	81
Energy	5	15	130	18	19	31	33	63	70
Other	52	72	80	54	54	70	70	111	111
Total	**813**	**1093**	**1447**	**694**	**710**	**784**	**843**	**973**	**1180**

Source: Basic Planning Directorate, Central Water Commission, XI Plan Document.
Report of the Standing Sub-Committee on "Assessment of Availability and Requirement of Water for Diverse Uses-2000".
Note- NCIWRD- National Commission on Integrated Water Resource Development; MoWR- Ministry of Water Resources; BCM- Billion Cubic Meters

Industrial Demand

Industrial activity requires large amounts of freshwater for activities such as boiling, cleaning, air conditioning, cooling, processing, transportation and energy production. As the country rapidly industrializes, greater quantities of water will be required. In India, the industrial demand for water resources has increased significantly due to the continuous growth of industrial sector over the past several decades. The industrial sector is the second highest user of water after agriculture in India. The estimations of national and international agencies on industrial water use in the country vary significantly. According to the MoWR, in India, industrial water use stands at about 40 BCM or nearly 6 percent of the total freshwater extraction. The

CPCB (2001) has estimated that the water consumption in Indian industry accounts for about 8 percent of the total fresh water use in India. However, the World Bank estimates placed water use in Indian industries at 13 percent of total fresh water withdrawal in the country. Despite differences, the estimates of industrial water use in the country by the three agencies have a point in common. All the three agencies concur that the industrial water use is growing rapidly in the country (CSE, 2004b). Hydroelectric generation also accounts for a large percentage of water demand. The potential in India has been estimated to be 84,000 MW, of which only 22,000 MW is currently being harnessed (MoWR, 2008).

2.3.3 Water Quality in India

The Central Pollution Control Board (CPCB) in collaboration with State Pollution Control Boards (SPCB) operates the Water Quality Monitoring Network (WQMN) comprising of 1700 monitoring stations in 27 States and 6 Union Territories spread over the country for monitoring of aquatic resources. The monitoring is undertaken on monthly/ quarterly basis in surface water and half yearly basis in cases of groundwater. The monitoring network covers 353 rivers, 107 lakes, 9 tanks, 44 ponds, 15 creeks, 14 canals, 18 drains and 490 groundwater wells. Presently, the inland water quality network is operated under three major schemes- Global Environmental Monitoring System (GEMS), Monitoring of Indian National Aquatic Resources (MINARS), and Yamuna Action Plan (YAP). The water quality monitoring results are analyzed with respect to the indicator of organic matter (Biochemical Oxygen Demand) and indicator of pathogenic bacteria (Total Coliform & Faecal Coliform). The water quality criterion for various uses of fresh water is expressed in terms of class and is given in Appendix- III.

The monitoring results obtained during 2009 indicate that organic pollution continues to be predominant pollution of aquatic resources. The organic pollution measured in terms of Bio-chemical Oxygen Demand (BOD) and Coliform bacterial count gives the indication of extent of water quality degradation in different parts of our country. It is observed that nearly 64 percent of the observations have BOD less than 3 mg/l, 19 percent between 3-6 mg/l and 17 percent above 6 mg/l. Similarly Total and Faecal coliform which indicate presence of pathogens in water are also a major concern. About 49 percent observations are having Faecal Coliform less than 500 MPN/100 ml (CPCB, 2009). While BOD excess can be the result of both domestic and industrial pollution, Coliform count is directly related to domestic waste water (Maria, 2003).

2.3.4 Water Pollution

Water pollution is a serious problem in India as about 70 percent of its surface water resources and a growing percentage of its groundwater reserves are contaminated. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities such as irrigation and industrial needs. Thus, the degraded water quality contributes to water scarcity as it limits its availability for both human use and the ecosystem. The type and sources of water contamination include "point" sources of pollution which usually refers to wastes being discharged from a pipe such as sewage and industrial effluents, which contain organic pollutants, chemicals and heavy metals; and "non-point" sources, which means all other sources such as storm water runoff (which picks up oils and other contaminants from various areas), irrigation (which carries fertilizers and pesticides into groundwater), leakages from storage tanks and leakage from disposal sites. The

non point sources are technically the most difficult to regulate in India (Raghupathy, 2002).

Every river in India is polluted to some degree. A combination of sewage disposal, industrial effluents, and chemicals from farm runoffs, arsenic and fluoride has rendered India's rivers unfit for drinking, irrigation, and even industrial purposes. New Delhi alone produces 3.6 million cubic meters of sewage every day, but, due to poor management less than half is effectively treated. The remaining untreated waste is dumped into the Yamuna River. New Delhi actually cannot get rid of the sewage it produces because 45% of the population is not connected to the public sewage system (Sengupta, 2006). In 2009, the CPCB had identified severely polluted stretches on 21 major rivers in India. The majority of these stretches were found in and around large urban areas (CPCB, 2009).

2.3.5 Sources of Water Pollution

Domestic Water Pollution

The domestic sector is responsible for majority of waste water generation in India. According to an estimate, 22 largest cities in the country produce over 7,267 million liters of domestic waste water per day, of which over 80 percent is collected for treatment (CSE, 1999). Inadequate treatment of human and animal wastes also contributes to high incidence of water related diseases in the country. According to an estimate, only 19.2 percent of the rural and 70 percent of the urban inhabitants have access to adequate sanitation facilities (WRI, 2000). Therefore, water contamination by human waste is often discharged directly into watercourses or seeps into the groundwater table from faulty septic tanks.

Agricultural Water Pollution

The rapid increase in agro-chemical use in the past six decades, has contributed significantly to the pollution of both surface and groundwater resources. Pesticide consumption rose from less than one million tonne in 1948 to a maximum of 75 million tonnes in 1990 (CSE, 1999). Per hectare consumption of fertilizers has increased from 69.8 kg in 1991-92 to 113.3 kg in 2006-07 at an average rate of 3.3 percent. Fertilizers and pesticides enter into the water supply through run-offs and leaching into the groundwater table. Excessive flows of fertilizers like phosphates and nitrogen from agricultural fields into rivers, ponds, lakes or seas help algae and large aquatic plants to grow widely over there. This process of nutrition supply to algae and weeds in water is called eutrophication. Due to eutrophication in any water, the BOD (Biological Oxygen demand) increases which indicates a higher degree of pollution. Studies on Ganga River indicate the presence of chemicals such as HCH, DDT, endosulfan, methyl malathion, dimethoate and ethion in levels greater than those recommended by the international standards (World Bank, 1999). Some of these substances have been known to bio-accumulate in certain organisms, leading to an increased risk of contamination when used for human consumption and a persistence of the chemicals in the environment over long periods of time. High levels of fertilizer use has been associated with increased incidence of eutrophication in rivers and lakes in several important water bodies of India, such as the Hussain Sagar in Hyderabad and Nainital in Uttar Pradesh (MoEF, 2009 a).

Industrial Water Pollution

Although the industrial sector only accounts for 8 percent of the annual water withdrawals in India, its contribution to water pollution, particularly in urban areas, is

considerable. Major industrial sources of pollution in India include the fertilizer plants, refineries, pulp and paper mills, leather tanneries, metal plating and other chemical industries. The problem of water pollution due to industries occurs due to the high concentration of industries over a small area and because of the inadequate measures adopted for effluent treatment of industrial activities. It is found that one-third of the total water pollution comes in the form of effluent discharge, solid wastes and other hazardous wastes (Murty, 2004). A substantial amount of these wastes are potentially hazardous for the environment. The waste water generation from this sector has been estimated to be 55,000 million m^3 per day, of which 68.5 million m^3 are dumped directly into local rivers and streams without prior treatment (MoWR, 2000). The surface water is the main source for drawing water and discharging effluents by industries. It is found that almost all the rivers are polluted in most of the stretches by some industry or the other. Waste water from industrial activities is often contaminated with highly toxic organic and inorganic substances, some of which are persistent pollutants and remain in the environment for many years. On account of increasing industrial development, inadequate zoning and emission regulations, the problem may aggravate in the coming years (MoEF, 2009a).

2.3.6 Adverse Impact of Water Pollution in India

Water pollution is a major cause of concern in India because in addition to causing ecosystem damage, it adversely affects health and thereby impairs economic productivity of people. Due to various factors, the quality of available water (surface and groundwater) is deteriorating continuously. The long term usage of contaminated water poses serious health hazards to the population. Around 85 percent of the rural population of the country uses groundwater for drinking and domestic purposes. High concentration of fluoride and arsenic in groundwater beyond the permissible limits of

1.5 mg/l and 0.05 mg/l respectively, poses severe health problems. While a long exposure to fluoride containing water causes tooth decay, damaged joints and bone deformities, arsenic contamination causes a disease called asenicosis, for which there is no effective treatment. Kumar and Shah (2004) have reported that arsenic contamination is the biggest mass poisoning case in the world putting 200 million people from West Bengal and Bangladesh at risk. Arsenic contamination in groundwater has been found in the states of Bihar, West Bengal, Uttar Pradesh, Assam and Chhattisgarh. It has been reported in 15 districts in Bihar, 10 districts in Uttar Pradesh, 8 districts in West Bengal and one district each in Chhattisgarh and Assam. In case of fluoride contamination, about 19 states in India have been identified as endemic areas of fluorosis, with an estimated 44 million people impacted and another 66 million at risk (MoWR, 2008).

Since water resources in India are deteriorating and depleting continuously, access to safe drinking water remains an urgent need as about 70.5 percent of the households in the urban areas and 8.7 percent in rural areas receives organized piped water-supply and the rest have to depend on surface or groundwater which is untreated. According to Census 2001, about 22 percent people do not have access to safe drinking water in India. The access to safe drinking water widely varies across states in India. The lowest 23.4 percent was found in Kerala and highest 97.6 percent was recorded in Punjab (Table 2.10).

Table: 2.10 Accesses to Safe Drinking Water in Households in India

(in Percent)

States	1981			1991			2001		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Andhra Pradesh	25.9	15.1	63.3	55.1	49.0	73.8	80.1	76.9	90.2
Arunachal Pradesh	43.9	40.2	87.9	70.0	66.9	88.2	77.5	73.7	90.7
Assam	NA	NA	NA	45.9	43.3	64.1	58.8	56.8	70.4
Bihar	37.6	33.8	65.4	58.8	56.5	73.4	86.6	86.1	91.2
Chhattisgarh	-	-	-	-	-	-	70.5	66.2	88.8
Goa	22.5	8.6	52.3	43.4	30.5	61.7	70.1	58.3	82.1
Gujarat	52.4	36.2	86.8	69.8	60.0	87.2	84.1	76.9	95.4
Haryana	55.1	42.9	90.7	74.3	67.1	93.2	86.1	81.1	97.3
Himachal Pradesh	44.5	39.6	89.6	77.3	75.5	91.9	88.6	87.5	97.0
J & K	40.3	28.0	86.7	NA	NA	NA	65.2	54.9	95.7
Jharkhand	-	-	-	-	-	-	42.6	35.5	68.2
Karnataka	33.9	17.6	74.4	71.7	67.3	81.4	84.6	80.5	92.1
Kerala	12.2	6.3	39.7	18.9	12.2	38.7	23.4	16.9	42.8
Madhya Pradesh	20.2	8.1	66.7	53.4	45.6	79.4	68.4	61.5	88.6
Maharashtra	42.3	18.3	85.6	68.5	54.0	90.5	79.8	68.4	95.4
Manipur	19.5	12.9	38.7	38.7	33.7	52.1	37.0	29.3	59.4
Meghalaya	25.1	14.3	74.4	36.2	26.8	75.4	39.0	29.5	73.5
Mizoram	4.9	3.6	8.8	16.2	12.9	19.9	36.0	23.8	47.8
Nagaland	45.6	43.4	57.2	53.4	55.6	45.5	46.5	47.6	42.3
Orissa	14.6	9.5	51.3	39.1	35.3	62.8	64.2	62.9	72.3
Punjab	84.6	81.8	91.1	92.7	92.1	94.2	97.6	96.9	98.9
Rajasthan	27.1	13.0	78.7	59.0	50.6	86.5	68.2	60.4	93.5
Sikkim	30.3	21.7	71.9	73.1	70.8	92.8	70.7	67.0	97.1
Tripura	43.1	31.0	69.4	67.4	64.3	74.2	85.6	85.3	85.9
Tamil Nadu	27.3	22.2	67.9	37.2	30.6	71.1	52.5	45.0	85.8
Uttarakhand	-	-	-	-	-	-	86.7	83.0	97.8
Uttar Pradesh	33.8	25.3	73.2	62.2	56.6	85.8	87.8	85.5	97.2
West Bengal	69.7	65.8	79.8	82.0	80.3	86.2	88.5	87.0	92.3
All India	**38.2**	**26.5**	**75.1**	**62.3**	**55.5**	**81.4**	**77.9**	**73.2**	**90.0**

Source: Economic Survey of India, 2002.

Conclusion

India's environment as reflected in its land, air and water resources was found to be considerably degraded. Use of modern technology in farming sector had damaged its soil and water resources. Intensive use of land and water resources made possible by modern technology has resulted in over-exploitation of these resources. The increasing level of pollution in air and water resources has reduced their availability for human use as well as for the development of the country. Moreover, pollution has caused severe health problems to the people.

In fact, environmental consequences of development in India have offset many benefits that may accrue to individuals and societies with rising incomes. There are direct costs on the health and longevity of individuals on the quality of life on account of deterioration in environmental quality. More importantly, if the factors of production are adversely affected as a result of deterioration in the environment, it can also undermine the future attainments and productivity.

Chapter - 3

Status of Forests in India

STATUS OF FORESTS IN INDIA

India is endowed with diverse forest types ranging from tropical wet evergreen forests in the northeast and the southwest, to tropical dry thorn forests in central and western India. The forests of India can be divided into 16 major types comprising 221 sub-types. Most of these forests are located in the Western Himalayas, East Deccan, North Eastern region including Himalayas and the Western Ghats (MoEF, 2012). These forests are important not only for meeting the demands of timber, fuel wood and fodder, but are also a major repository of biodiversity. They also supply a wide range of essential ecosystem goods and services, and provide livelihoods to millions of forest dependent people. However, forests are an almost neglected sector in the structure of Indian economy and are consistently undervalued in economic and social terms.

Although India has been able to reduce the rate of deforestation and there has been an increase in the total forest cover of the country in recent years, it has been because of increase in the tree plantations (such as agroforestry plantations, coffee and tea estates with trees, fruit orchards, coconut crops, etc.), which have been treated as forests since 2001 by Forest Survey of India (FSI). However, the quality of existing forest stock is still deteriorating due to a number of factors. While India has only 2.4 % of the world geographical area, it has 17% of the world population and 18% of livestock. Moreover, India's per capita forest cover is 0.064 ha against the world average of 0.64 ha. Consequently, India's forests are facing biotic pressure resulting in deterioration in quality of forest cover as well as their productivity. The unsustainable exploitation of forest resources has resulted in their degradation which has been estimated as 41% by the National Forest Commission (MoEF, 2006a). The

productivity of India's forests is also low (1.34 m^3/ha/year) when compared to the world average (2.1 m^3/ha/year) (The Eleventh Five Year Plan, 2007-12).

3.1 Relevance of Forests in Indian Economy

There has been increasing realization of the role of forests in social, cultural, economic and industrial development of the country and in maintaining its ecological balance. By providing various socio-economic and ecological services, forests help in achieving equitable and inclusive growth along with protecting natural heritage for sustainable development of the economy. Forests also provide an opportunity to optimize broad-based development and poverty reduction of the forest-dependent communities as well as addressing global concerns of climate change and conservation of biological diversity (GOI, 2006a). The role of forests in Indian economy is examined by classifying it into two categories-socio-economic relevance of forests and ecological role of forests.

3.1.1 Socio-Economic Relevance

Indian Forests account for a number of products such as timber, fuel wood, fodder, bamboo, gum, resin, tanning material, medicinal herbs, grasses, etc. It is estimated that about 270 million tonnes of fuel wood, 280 million tonnes of fodder, over 12 million cubic meter of timber and countless Non-Wood Forest Products (NWFPs) are provided by forests annually. At a conservative level of pricing, the value of these commodities will approximately aggregate to over Rs. 27,500 crores per annum. However, due to the transaction of large extent of these material benefits outside the market system, their reflected value in national accounts (GDP) is less than 10% of its real value (GOI, 2006).

Forests also offer huge potential for poverty reduction and rural economic growth in India. An estimated 275 million rural poor in India (27% of India's population) depend on forests for at least part of their subsistence and livelihoods from fuel wood, fodder, and a range of NWFPs such as fruits, flowers, and medicinal plants. About 70% of India's rural population depends on fuel wood to meet domestic energy needs (Malhotra and Bhattacharya, 2011). According to an estimate, forests meet nearly 40% of the energy needs of the country, of which, more than 80% is utilized in rural areas (GOI, 2006a). Half of India's 89 million tribal people, the most disadvantaged section of society, live in forest fringe areas and tend to have close cultural and economic links with the forest. For landless families and marginal farmers, forest related activities have provided the primary source of income (World Bank, 2008).

Besides, forests provided raw materials to a number of major and minor industries in India, such as saw mills, pulp and paper, plywood, polyfibres, match, tannins and to many drug industries. These industries have been a gainful source of employment in the primary, secondary and tertiary sectors all over the country. Dhyani *et al.* (2007) have been estimated that in the primary and secondary sectors, forestry activities generate employment of approximately 240 million person days per day. According to them, forest-based enterprises generate high level of employment to the tune of 30 million people in India. Outstanding among the products that create jobs are oil seeds (36.5 million humandays/year), gums and resins (31.3 million humandays/year), bamboo (17.5 million humandays/year) and kapok floss (3.6 million humandays/year).

3.1.2 Ecological Relevance

Apart from various socio-economic services (tangible benefits), forests also provide various ecological and environmental services (intangible benefits) such as provision of water and its recharge and purification, prevention of soil erosion, regulation of flood control, provision of nutrients through rivers and streams to enhance agriculture productivity, storm protection services, particularly by mangroves, biodiversity conservation, carbon store and carbon sequestration, etc.

Forests as Watersheds

Water and fertile soil are the two most important prerequisites of our food security. Both are irrevocably linked with forest and watershed conservation. As an integral part of the watershed, forests regulate the water regime, conserve soil and control floods. Because of the thick humus layer, loose soil and the soil retaining power of tree roots, forests are vitally important for maintaining and regulating water-flows and sub-soil water-regimes. In fact, water flow, both quantitative and qualitative, may now be regarded as the single greatest product of forests, since most of our rivers and streams emanate from forests and forests constitute the upper catchments of these water bodies (MoEF, 2006a).

Conservation of Biological Diversity

A most significant function of forests is that they serve as storehouses of biological diversity. They provide natural habitat for wildlife and the ecological conditions for maintenance and natural evolution of genetic diversity of flora and fauna (MoEF, 2006b). In India, there is great diversity of natural ecosystems. The country is one among the 12 mega-diversity countries of the world and has a rich heritage of species and genetic strains of flora and fauna. It has also two global

terrestrial biodiversity hot spots- the North Eastern Himalayas and the other is the Western Ghats. The panorama of Indian forests ranges from evergreen tropical rain forests in the Andaman and Nicobar Islands, the Western Ghats, and the North-Eastern States, to dry alpine scrub high in the Himalayas to the north. Between the two extremes, the country has semi-evergreen rain forests, thorn forests, subtropical pine forests in the lower mountain zone and temperate mountain forests (MoEF, 2009a). Naturally, such a diverse flora provides for a very diverse fauna. The public forests dedicated to the protection of wildlife habitats include 96 national parks and 509 wildlife sanctuaries. The total area of 21.39 Mha, which covers 27.8% of the total recorded forest area, is maintained under the protected area network (FSI, 2011).

Forests as Carbon Sinks

The role of forests in carbon sequestration has significantly increased the importance of forestry as a climate change mitigation strategy. Forests, particularly tropical contribute more than other terrestrial biomes to climate relevant cycles and processes (Chaudhry and Arora, 2010). They influence climate and the climate change process mainly by effecting the changes in the quantum of CO_2 in the atmosphere. They absorb CO_2 from atmosphere and store carbon in wood leaves, litter, roots and soil by acting as 'carbon sink' (FAO, 2006). Globally, forests store more than 55% of the global carbon stored in vegetation. Recent studies suggest that about 11 million hectares of forests each year are lost in tropical regions due to deforestation and conversion of land to agriculture resulting in the emissions of about 3.6 to 4.5 billion tons of CO_2, so that deforestation accounts for around 17% of the global carbon emissions. In Indian context, recent estimates suggest that in a period of 10 years, from 1995 to 2005, there is an annual increment of 37.68 million tons in

carbon stocks stored in Indian forests which means an annual removal of 138.15 million tons of CO_2eq (Kishwan *et al.*, 2009).

3.2 Forest Cover in India

The forest cover, as reported in ISFRs of Forest Survey of India, refers to all lands more than one ha in area with a tree canopy density more than 10 percent (FSI, 2011). The first attempt to assess forest cover in India using satellite data was made by National Remote Sensing Agency (NRSA) in mid 1984. NRSA interpreted the Landsat imagery and published two sets of forest cover data, one for 1972-75 and another for 1980-82. The data revealed that during these seven years, the forest cover of the country decreased by 91,710 sq. km (from 555,180 sq km in 1972-75 to 463,470 sq km in 1980-82). The annual loss of forest cover worked out at 13,000 sq. km. According to CSE's Fifth Citizens' Report (1999), most of these forests were natural forests as there was very limited area under plantations at that time. However, according to FSI (1989), the NRSA estimates suffered from many inadequacies and did not represent the correct picture of the forest cover in the country.

Almost simultaneously, the FSI, an organization under the Ministry of Environment and Forests (MoEF), Government of India, also developed capability of interpreting satellite data for assessment of forest cover. The first assessment of forest cover by FSI was brought out in the State of Forest Report, 1987. Its initial estimate of forest cover of the country was 64.87 million ha (19.70%) of the land area. A reconciliation exercise between NRSA and FSI led to the final figure of 64.20 million ha (19.52%) of forest cover in India. After this, FSI started assessing forest cover status of the country on a biennial basis and the findings are reported in the subsequent SFRs.

The assessments are principally based on interpretation of satellite data. The techniques of assessment have changed and improved over time due to progress in technology in the field of remote sensing, data acquisition and processing and improvement in the method of interpretation. For instance, in the first assessment, reported in SFR 1987, the satellite data was interpreted visually at the scale of 1:1 million. The minimum mappable area of forest in this assessment was 400 ha. Subsequent assessments till 1999 were based on visual interpretation of satellite data at the scale of 1:250,000 with the minimum mappable area of 25 ha. From 2001, the interpretation of satellite imageries became fully digital and the scale of mapping was improved to 1:50,000. With the adoption of digital method of interpretation, FSI has been able to delineate and record all the forest areas down to 1 ha in extent. The technological and methodological changes in the forest cover assessment of India, since the first report of 1987, are summarized in Table 3.1.

Table 3.1 Forest Cover Mapping in India (1987-2011)

Cycle of Assessment	Year	Data Period	Sensor	Resolution	Scale	Minimum mappable area (ha)	Mode of Inter-pretation
First	1987	1981-83	LANDSAT-MSS	80 m	1:1 million	400	Visual
Second	1989	1985-87	LANDSAT-TM	30 m	1:250,0000	25	Visual
Third	1991	1987-89	LANDSAT-TM	30 m	1:250,0000	25	Visual
Fourth	1993	1989-91	LANDSAT-TM	30 m	1:250,0000	25	Visual
Fifth	1995	1991-93	IRS-1B LISS II	36.25 m	1:250,0000	25	Visual & Digital
Sixth	1997	1993-95	IRS-1B LISS II	36.25 m	1:250,0000	25	Visual & Digital
Seventh	1999	1996-98	IRS-1C/1D LISS III	23.5 m	1:250,0000	25	Visual & Digital
Eighth	2001	2000	IRS-1C/1D LISS III	23.5 m	1:50,000	1	Digital
Ninth	2003	2002	IRS-1D LISS III	23.5 m	1:50,000	1	Digital
Tenth	2005	2004	IRS-1D LISS III	23.5 m	1:50,000	1	Digital
Eleventh	2009	2006	IRS-P6 LISS III	23.5 m	1:50,000	1	Digital
Twelfth	2011	2008-09	IRS-P6 LISS III & IRS-P6	23.5 m & 56 m	1:50,000	1	Digital

Source: State of Forest Report, 2011, Forest Survey of India

3.2.1 Current Status of Forest Cover

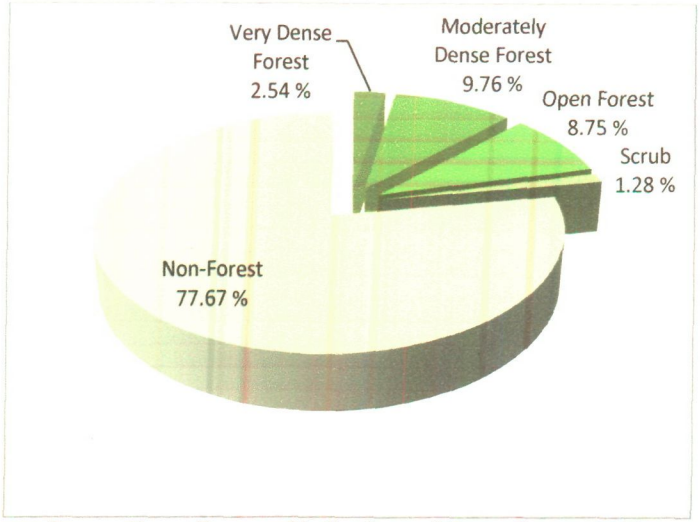
As per the latest assessment of Forest Survey of India in 2011, total forest cover of India is 692027 km^2 which works out as 21.05% of the total geographical area of the country. The forest cover has been further classified on the basis of tree canopy density into Very Dense Forest (more than 70% crown density), Moderate Dense Forest (40% to 70% crown density) and Open Forest (10% to 40% crown density). They account for about 12.06 %, 46.35 % and 41.95 % of the total forest cover respectively and also include mangrove cover of the corresponding density class. However, they comprise only 2.54 %, 9.76% and 8.75% respectively as far as their contribution in the total land area of the country is concerned. Of the total forest cover, only 404207 km^2 (12.3%) of area comprises dense forest (very dense and moderately dense forest) with more than 40% crown density. Thus, only 12.3% of the total land area of the country has adequate forest cover. Scrub, though shown separately, is not counted in the forest cover. The country level forest cover is summarized in Table 3.2 and their proportion is depicted in a pie chart in percentage terms in Figure 3.1.

Table 3.2 Forest Cover of India in 2011

Class	Area (sq.km.)	% of Geographical Area
Forest Cover		
a) Very Dense Forest	83,471	2.54
b) Moderately Dense Forest	320,736	9.76
c) Open Forest	287,820	8.75
Total Forest Cover[1]	692,027	21.05
Scrub	42,176	1.28
Non-forest	2,553,060	77.67
Total Geographical Area	3,287,263	100.00

Source: Forest Survey of India, State of Forest Report, 2011.
[1] Includes 4662 km^2 area under mangroves.

Figure- 3.1 Forest Cover of India in 2011



Source: Forest Survey of India, State of Forest Report, 2011.

3.2.2 Regional Variations in Forest Cover

Although forest coverage is about 21.05 % at the national level, the proportion varies widely among states (Appendix IV), minimum being 3.5 % in Punjab and maximum 90.7 % in Mizoram. This variation is expected due to location of States in different climatic zones and their topography (Raut, 2004). For instance, north-eastern region of the country comprising seven States, namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura is endowed with rich forest resources. The region, which constitutes only 7.98 % of geographical area of the country, accounts for nearly one fourth (24.5 %) of its total forest cover. The total forest cover in the region is 173219 km^2, which is 66.07 % of its geographical area in comparison to the national forest cover of 21.05 %. Similarly, forest cover in six Union Territories (UTs) viz. Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman and Diu and Lakshadweep and is about 74.2% of their total geographical area, but it accounts for only 1% of total forest area in the country. Nearly 58 % of India's forests are categorized as dense forests and 42% as open

forests. The proportion of dense forests (tree cover with canopy density of 40 % and above) and open forests (tree cover with canopy density of 10-40 %) also varies considerably among States. This is clear from the fact that only three States namely, Madhya Pradesh, Arunachal Pradesh and Chhattisgarh account for nearly 1/3rd (32.9%) of the dense forest in the country, however, they comprise only 16% of the total geographical area of the country. Thus, interstate variations in relatively proportionate geographical area under forests are quite substantial.

Besides, wide disparities also exist in terms of per capita availability of forest cover between different States. The availability varies from 4.88 km^2 per person in Arunachal Pradesh to 0.01 km^2 per person in Bihar, Uttar Pradesh, Punjab, Haryana and West Bengal. Apart from these, there are many forest poor states with less than a critical minimum area of 0.1 km^2 per person viz. Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Rajasthan, Tamil Nadu, Assam and Jharkhand.

3.2.3 Trends in Forest Cover (1987 to 2011)

As mentioned earlier that the Forest Survey (FSI) of India has been regularly assessing the forest cover of the country on a two-year cycle since 1987. The updates in terms of changes in forest cover and its different components (i.e. dense forests and open forests) are regularly published in various State of Forest Reports (SFRs). Till now, twelve cycles of forest cover assessment have been completed and the latest was published in SFR, 2011. Table 3.3 presents the trends in total forest cover, dense forest and open forest in India from 1987 to 2011.

Table 3.3 Trends in Forest Cover (1987 to 2011)

Years	Total Forest Cover		Dense Forest		Open Forest	
	Area (sq km)	% of TGA	Area (sq km)	% of TFC	Area (sq km)	% of TFC
1987	642041	19.5	361412	56.3	276583	43.1
1989	640134	19.5	378470	59.1	257409	40.2
1991	639182	19.4	385008	60.2	249930	39.1
1993	640107	19.5	385576	60.2	250275	39.1
1995	639600	19.5	385756	60.3	249311	39.0
1997	633397	19.3	367260	58.0	261310	41.3
1999	637293	19.4	377358	59.2	255064	40.0
2001	653898	19.9	395169	60.4	258729	39.6
2003	677816	20.6	388574	57.3	289242	42.7
2005	690171	20.9	403420	58.5	286751	41.5
2009	690899	21.02	403666	58.3	288377	41.7
2011	692027	21.1	404207	58.4	287820	41.6

Source: Forest Survey of India, State of Forest Reports 1987 to 2011.

It is clear from Table 3.3 that all the components of forest cover have recorded an increase from 1987 to 2011. The total forest cover increased by 49986 sq km from 1987 to 2011. Similarly the area under dense and open forests has increased by 42795 sq. km and 11237 sq. km respectively in the same period. However, due to changes in the technique and scale of interpretation from 2001 (Table 3.1), any direct comparison of forest cover assessments since 2001 (i.e. from 2001 to 2011) with that of prior assessments till 1999 (i.e. from1989-1999) would be invalid (FSI, 2001). It is because of this reason, the data for analyzing the changes/ trends in forest cover from 1989 to 2011 has been divided into two time periods- Period A (1989 to 1999) and Period B (2001 to 2011) (Table: 3.4).

Table 3.4 Change in Forest Cover (1989 to 2011)

Category/Year	Period A				Period B			
	1989	1999	Change in 1999		2001	2011	Change in 2011	
			Area	%			Area	%
Dense Forest	378470	377358	-1112	-0.3	395169	404207	9038	2.2
Open Forest	257409	255064	-2345	-0.9	258729	287820	29091	10.1
Total Forest	640134	637293	-2841	-0.4	653898	692027	38129	5.5

Source: Forest Survey of India, State of Forest Reports 1989, 1999, 2001 & 2011.

As far as changes in different components of forest cover is concerned, only marginal changes are observed during Period A, from 1989 to 1999 at all-India level (Table 3.4). Over the period of ten years, the total forest cover of the country declined by 0.4 percent while the area under dense and open forest cover declined by 0.3 and 0.9 percent respectively. On the other hand, during Period B, from 2001 to 2011, significant increasing trends were recorded in different components of forest cover at all India level. The total forest cover of the country increased by 5.5 percent with 2.2 percent increase in dense forests and 10.1 percent increase in open forests. In terms of area, the forest cover recorded an increase of about 38129 sq km, out of which 9038 sq km (23.7%) was due to increase in dense forest and 29091 sq km (76.3%) was due to increase in open forests.

However, this increase in forest cover (in Period B), is mainly on account of technological and methodological changes incorporated in the forest cover assessment since 2001 (Table 3.1). For instance, with the adoption of new technology in 2001 when the assessment for the entire country was done digitally on 1:50,000 scale, it had become possible to capture forest cover patches down to 1 hectare. Thus, the increase in forest cover during Period B was partially due to the capture of some additional forest patches (FSI, 2005). Moreover, 'forest cover' was redefined as consisting of all lands, more than one hectare in area, with a tree canopy density of more than 10 percent, irrespective of land use and ownership. Consequently, all perennial woody vegetation (including bamboos, palms, coconut, apple, mango, neem, peepal, etc.) has started to be treated as tree cover since 2001 (FSI, 2001). While before 2001 (i.e. from 1989 to 1999), forest cover was largely confined to the assessment of large continuous wooded lands and only plantations were included in the total forest cover along with the natural forests. Areas identified during ground

truthing having other land uses or under private ownership were deliberately excluded from forest cover. Since 2001, all lands with tree crops, such as agroforestry plantations, fruits orchards, tea and coffee estates with trees, etc., which are not actually forests, have also been included in total forest cover in the category of open forest (FSI, 2001). As a result, the open forest, which has shown a decline of 2345 sq km (0.9%) during Period A, (1989 to 1999), has tremendously increased by 29091 sq km (10.1%) during Period B, (2001 to 2011) (Table 3.4). As the total forest cover has largely increased due to increase in open forest (76.3%) during Period B, the increase may also be attributed to the compositional changes in the definition of forest cover to include additional tree crops apart from technical and methodological changes in forest cover assessment.

Some studies may also be quoted in this regard. For instance, the Sub-Group-I on Forestry (2011), constituted by Planning Commission of India in its report has analyzed the trends in forest cover from 2001 to 2007. It was found that the forest cover has quantitatively increased during the period due to increase in plantations, limited harvesting of timber as well as protection and management accorded by Forest Department and Village Forest Protection Committees (VFPCs). However, according to the report, the quality of forest cover and the productivity from forest areas have generally declined during the period owing mostly to biotic pressures like grazing, human interference, habitat fragmentation, forest fires, etc. The assessment of forest cover by FSI using satellite imagery was also criticized by Puyravaud *et al.* (2010) as it fails to distinguish native forests from tree plantations, which are often monocultures of exotic species that have limited value for endangered biodiversity. The authors in their study 'Cryptic Destruction of India's Native Forests' have repudiated the government claim of 5% increase in forest cover between 1997 to 2007

by pointing out that large chunks of this cover were actually made up of exotic tree plantations such as eucalyptus and acacia. When the plantations were subtracted from the total forest cover, the figures showed a 1.5 to 2.7 % shrinking of India's natural forests each year. The researchers observed that between 1997 and 2007, there was a sharp decline of natural forests from 514,137 sq. km to 389, 970 sq. km. Conversely, in the same period, there was a rise in total forest cover from 660,337 sq km to 690,250 sq km, the tree plantation grew rapidly from 146,200 sq km to 389,970 sq km. The rise in forest cover was thus entirely due to the tree plantations or 'artificial forests'.

Thus, it is clear that apart from technological and methodological changes in the forest cover assessment, the increase in forest cover over the period of time from 1989 to 2011 is not because of increase in native forests but it is mainly due to the addition of tree plantations or 'artificial forests' in the total forest cover.

3.3 Major Issues OF Forests in India

3.3.1 Forest Degradation

India has been able to arrest the rate of deforestation and the area under forest has increased to a small extent in the recent years. However, forest degradation appears to be continuing, which is evident from the low level of growing stock in Indian forests. The growing stock per ha of forest area as per both in 2009 and 2011 ISFRs is estimated to be around 58.46 m^3 per ha of forest area. This is far below the global average of 130.7 m^3/ha and the South and Southeast Asian average of 98.6 m^3/ha for the corresponding period (FAO, 2006). Moreover, more than 40 per cent of the forests in country are degraded and under-stocked (Aggarwal *et al.*, 2009, Bahuguna *et al.*, 2004). The National Forest Commission report 2006 indicated that

around 41 per cent of total forest in the country is degraded, 70 per cent of the forests have no natural regeneration, and 55 per cent of the forests are prone to fire (MoEF, 2006a). The factors affecting forest degradation in India are demand and supply gap of forest products, diversion of forest land for non-forestry use, encroachments, shifting cultivation, over and unregulated grazing in forest areas, and forest fires (FSI, 2011; Davidar *et al.*, 2010; Aggarwal *et al.*, 2009; MoEF, 2009b; MoEF, 2006a).

Factors affecting Forest Degradation

Demand and Supply Gap of Forest Products

India's huge population contributes to the large demand base of the forest products. With limited forest cover, the supply of forest products does not match the demand and hence there is a substantial gap between demand and sustainable supply of various forest products such as fuel wood, timber and fodder in India. This often leads to unsustainable exploitation, thereby resulting in degradation of forests. These degraded forests, in turn, provide even less to these products and services, thus, resulting in a vicious cycle where the demand and supply gap of the products results in unsustainable exploitation of resources and vice versa (CAEP-TERI, 2011) There has been different estimates of the demand and supply of major forest products. The estimates by TERI (Aggarwal *et al*, 2009) put the demand-supply gap for fuel wood, fodder and timber at 100, 853 and 14 million tonnes respectively (Table 3.5).

Table 3.5 Demand and Supply Gap of Forest Products (2004)

Forest Products	Demand (MT)	Sustainable Supply (MT)	Gap/Unsustainable Harvest (MT)
Fuel wood	228	128	100
Fodder (green & dry)	1594	741	853
Timber	55	41	14

Source: Aggarwal *et al*, 2009
Data is based on TERI estimates and compilation.

The ISFR 2011 made an estimation of consumption of woods by commercial and household sectors for various purposes and production potential of woods from forest sources as well as from tress outside forest (Table 3.6). The total annual consumption of wood in constructions and furniture – both in commercial and household sector – as well as for agricultural implements are estimated to be 48.0 million cubic meters (m cum) in Round Wood Equivalent (RWE). However, the total production of timber stands at 45.95 m cum, showing a gap of 2.05 m cum annually (FSI, 2011).

Table 3.6 Consumption and Production of Forest Products (2011)

Forest Products	Consumption	Production
Wood (RWE in million cubic metre)	48.0	45.95
Fuelwood (million tonnes)	58.47	19.25[a]
Fodder (Livestock dependence on Forests) (in million)	199.58	

Source: India State of Forest Report (ISFR), 2011, Forest Survey of India.
[a] Annual availability of fuel wood from Trees Outside Forests (TOF).

In terms of volume extracted, fuel wood is the most important produce of India's forests. Of the total demand for wood in the country, it is estimated that over 80 % of the demand is just for fuel wood. As per the 2011 Census, 49 % of the households in the country use fuel wood for cooking. The MoEF (2006a) has estimated India's annual demand for fuel wood at 200 million tonnes (MT), 49% of which comes from farm forestry and the remaining 51% from natural forests. Thus, it is implied that 100-115 MT of fuel wood is extracted from natural forests, which is 6-7 times higher than the estimated sustainable supply of 17 MT from those forests. This unsustainable extraction of fuel wood is one of the primary reasons for degradation of Indian forests. There are various studies which indicate this correlation (Bhattacharya and Joshi, 2000; Hertberg, Arndt, and Shekhar, 2000). Apart from

these, about 199.38 million (38.49%) livestock was estimated to be dependent , partially or completely, on forests for feed, either through small feeding or grazing.

Diversion of Forest Land for Non-Forestry Use

Diversion of forests for developmental activity has a major impact on India's forest cover and its quality. Since independence, forest land was prime target for its diversion for resettlement, agriculture, industrialization and the trend was continued by the Forest (Conservation) Act (FCA) 1980. During the period 1951 to 1980, as many as 42.38 lakh ha of forest lands were diverted to non-forest use. According to the FSI (1987), official diversion of forest lands for non forestry use since 1950s has been an important factor behind the reduction in the productivity of goods and services from forests. In 1980, FCA was enacted to provide priority to conservation of forests by regulating the diversion of forest land for non-forest activities. Now the prior approval of the Centre was required for diversion of forest land for non-forestry purposes (see details in Chapter 5). However, despite the passing of the FCA, diversion of forest land was continued. Since the Act came into force in 1980, 23,404 proposals related to developmental activities, rehabilitation of displaced families as well as encroachment have been approved by diverting 11.99 lakh ha of forest land over the period (approximately 30 years) 1981 to 2011. The average annual diversion of forest land after the Act is about 0.36 lakh ha where as prior to Act it was 1.5 lakh ha (MoEF, 2010). Although the rate of diversion has come down with the implementation of FCA 1980, there is still a significant amount of area being diverted for non forestry purposes. Purpose wise area of diverted forest land for both the periods is presented in the Tables 3.7(a) & (b).

Table 3.7 (a) Diversion of Forest Lands before Forest Conservation Act (1951 to 1980)

Purpose	Area (lakh hectares)
Agriculture	26.23
River Valley Project	5.02
Industries	1.34
Transmission Lines and Roads	0.61
Miscellaneous	10.08
Total	**42.38**

Source: Source: Forest Sector Report India 2010, MoEF

Table 3.7 (b) Diversion of Forest Lands after Forest Conservation Act (1981 to 2011)

Purpose	Area (lakh hectares)
Defense	0.46 (3.8)
Encroachments	3.7 (30.8)
Social Services	0.65 (5.4)
Roads & Railways	0.63 (5.2)
Power Projects	1.64 (13.7)
Mining	1.49 (12.4)
Irrigation	1.67 (13.9)
Miscellaneous	1.75 (14.6)
Total	11.99 (100.0)

Source: Forest Sector Report India 2010, MoEF

It is clear from Table 3.7(a) & 3.7(b) that while prior to the Act, the bulk of diversion of forest land was for agriculture purposes, which was about 26.23 lakh ha (60%), in the post Act period, largest chunk of forest land, about 3.7 lakh ha (30.8%), was diverted for regularization of encroachment. Bulk of the regularization was in 1990 and 2001. Only about 5.4 per cent of the total forestland diverted has been for social services which include dispensary/hospital, disputed settlement claims, drinking water projects, forest village conversion, rehabilitation, village schools, etc (CSE, 2012). According to CSE (2012), maximum diversion of forestland during the post Act period (1981-2011) was occurred in the last four years, from 2007 to 2011.

During this period, 8,284 projects were granted forest clearance and 2.04 lakh ha of forestland was diverted. This is about 25 per cent of all forestland diverted for development projects since 1981. Even, in one single year- 2009, as much as 0.88 lakh ha of forestland was granted clearance. The pace of forestland diversion, therefore, doubled in these five years.

Encroachment on Forest Land

The ever-increasing demand for regularization of encroachments on forest lands is one the most important reasons for degradation of forests. Encroachment on forest lands especially for cultivation had been a regular phenomenon since independence. As the population grew, there was more and more demand for land for agriculture. Various States and Union Territory Governments officially diverted as many as 2.623 million hectares of forest lands for agriculture during the period from 1951 to 1980. In addition, many hectares of unoccupied non-forest government lands were also allocated for agriculture. It was also reported that many State Governments, especially Madhya Pradesh, Maharashtra, Karnataka and Gujarat regularized the unauthorized occupations of forest lands for cultivation many times before the enforcement of Forest (Conservation) Act (FCA) 1980 (FSI, 1987).

In 1980, the FCA ensured that no diversion of forest land is possible without the prior approval of the Government of India. Besides, the National Forest Policy, 1988 stipulated that there would be no regularization of existing encroachments on forestland. However, the Ministry of Environment and Forests (MoEF), under pressure from States, evolved a national consensus on the issue and issued guidelines on September 1990 on regularization of pre-1980 encroachments. It was decided that all post-1980 encroachments would not be regularized. But, the encroachment of

forest land, and socio-economic pressures to regularize them were continued even after 1980. Till 2001, the Central Government alone had regularized encroachment of over 3.66 lakh hectares of forestland in Madhya Pradesh, Gujarat, Kerala, Arunachal Pradesh, Karnataka, Orissa, Tripura and Andaman and Nicobar Islands. Thus, encroachment on forest land is an ongoing process. As on 31st March 2004, around 13.43 lakh ha of forest land was reported under encroachment (MoEF, 2006a).

Mining in Forest Areas

The requirements of economic development make the extraction of the nation's mineral resources an important priority. But, mining is closely associated with forestry and environment issues as a major part of the nation's known reserves of some key minerals are in areas which are under forest cover. Thus, mining activity is an intervention in the environment, and if unregulated, has the potential to adversely disturb the ecological balance of an area (MoEF, 2006a). As far as the diversion of forest land for mining is concerned, about 1098 cases were approved for 0.088 million ha of forest area from 1980 to 2004 and 211 cases were approved for 0.012 million ha of forest area from 2005 to 2009 under Forest (Conservation) Act 1980 (Lok Sabha Debates, 2009). Thus, there is a need to design a framework of sustainable development, which takes care of bio diversity issues and to ensure that mining activity takes place along with suitable measures for restoration of the ecological balance.

Forest Fires

In India, forest fire is a widespread and recurring phenomenon and causes extensive damage to forests. Some fires are incidental, but majority of them are man-made and are created to facilitate extraction of a variety of NTFPs such as tendu

leaves, sal seeds and honey to have a good yield of grass, and for clearing the forests for shifting cultivation purposes. In some parts of the country, forests are set on fire for socio-cultural and religious purposes (CAEP-TERI, 2011). As there is no accurate assessment of such damages by the State Forest Departments (SFDs), reliable data on the extent of burnt forests area and value of the forest crop destroyed due to forest fire are not available. There is also a tendency of under reporting the severity and extent of burnt areas. However, FSI has been collecting data by recording the incidence of forest fires during National Forest Inventories (NFI). Based on the analysis of about 22,000 sample plot data collected during 2002 to 2008 from all over the country, FSI has estimated that about 2.94 million ha forests or 3.69 per cent of the recorded forest area, are annually affected by mild to heavy ground fire of which 1.64 million ha is affected by moderate to heavy fire (ICFRE, 2010). In most cases, fire protection is based on a system of fire lines, which is inadequate and ineffective due to lack of funds (MoEF, 2006a).

Shifting Cultivation

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, and then abandoned (Tripathi and Barik, 2003). This unscientific form of land use affects 10 Mha of forest area across 16 states especially in the north-eastern part of the country. The practice of shifting cultivation has been a major factor responsible for forest loss in these areas. There are varying estimates, which indicate that around 3 to 26 million people are involved in this practice (MoEF, 2006a). Earlier, this practice was in harmony with the regeneration capacity of forests but over the years due to increase in population, the rotation cycle of shifting cultivation has decreased from 20 to 4 years. This has resulted in large scale degradation of forests. Productivity of these lands has also come down, which has

made people undertake intensive agriculture, further degrading the forests (CAEP-TERI, 2011).

Open and Unregulated Grazing

Open and unregulated grazing is another important cause of forest degradation in India. It has adverse impact on growing stock as well as on regeneration capacity of forests. A substantial percentage of pasture and grazing lands has been encroached upon for agricultural and other purposes. The reduction in extent of pasture and grazing lands, and loss in their productivity has led to more and more forests being used as grazing lands (FSI, 1987). India's total fodder consuming livestock population as per the 2007 Livestock Census is estimated to be 518.6 million. Of these 199.6 millions of livestock, depend, partially or fully on forest for fodder (FSI, 2011).

3.3.2 Insufficient Database and Information Systems for Management Planning

Information and monitoring systems for the forest sector are instrumental for effective policies and planning, valuation of forest resources, efficient investments, and engendering accountability. The development of systems for collecting, maintaining and disseminating forest-sector statistics is essential for sustainable forest management. However, according to Indian forestry experts, the availability, accessibility, consistency, reliability and quality of data and information relating to Indian forestry sector is a major concern for policymakers and scientists.

While highlighting a national concern on inadequacy of forest resource information, the National Forest Policy (NFP) of 1988, in its Section 4.14, has emphasized on the need for information collection and dissemination of forests statistics. Section 4.14 entitled "Forest Survey and Database" states:

"Inadequacy of data regarding forest resources is a matter of concern because this creates a false sense of complacency. It is imperative to comple the survey of forest resources on scientific lines and to regularly update information. For this purpose, periodical collection, collation and publication of reliable data on relevant aspects of forest management needs to be improved with recourse to modern technology and equipment".

Although mandated in the NFP, a comprehensive and systematic mechanism for collection, collation, analysis and dissemination of forestry data at the national level is yet not available. The statistical reporting in the forest sector has been inadequate to meet both national and international requirements. There is no reliable assessment of the growing stock of trees at state level. Other deficits include a lack of data on different products from forests and a lack of increment in biomass data. It is difficult to make economic assessments and set policies without quality data and information on both the tangible and intangible benefits of forests.

Although, the FSI in its State of Forest Reports provides information on forest cover of the country, it does not provide separate information on the area under plantations as well as on natural forests. As these reports do not talk about natural forests, they also tend to leave the impression that the dense forest cover largely consists of natural forests. However, according to CSE's Fifth Citizen's Report (1999), these impressions are wrong as a part of dense forests also consists of plantations and regenerated natural growth apart from undisturbed pristine forest cover. Thus, the current information is below the requirements to support sustainable forest management.

3.3.3 Undervaluation of Forestry Sector

Despite making significant contribution to India's economic and ecological systems, India's forests have not been given due recognition in the national accounts. The current approach for accounting of forestry sector contribution to GDP grossly under estimates their contribution to the national economy due to insufficient accounting of tangible benefits of forests, non-recording of intangible benefits, non-recording of unauthorized extraction and insufficient recordings of losses in the forests (MoEF, 2006c). Contribution of forests to the economy is traditionally recognized through tangible products of calculated value like timber and other forest products but a range of non-priced as well as highly subsidized products such as fuel-wood, fodder and a range of NTFPs including medicinal plants that are exchanged in an informal manner outside the market system, are not measured. The limited market exchange of various forest products results in gross undervaluation of the contribution of the forests, which has led to an inadequate allocation of funds to the forestry sector (GOI, 2011).

Moreover, the intangible services provided by forests such as watershed function, prevention of soil erosion, regulation of floods, carbon store and carbon sequestration, biodiversity conservation and recreational, cultural and aesthetic services are also ignored due to absence of an appropriate market system (MoEF, 2006c). The Tenth Five Year Plan (2002-07) document also states that the potential of forests to reduce poverty, realize economic growth, and their contribution to the local and global environment has not been fully realized due to a combination of market and institutional failures. Thus, forests are consistently and seriously undervalued in economic and social terms (GOI, 2006). The value of forests reflected in the System of National Accounts (SNA) represents less than 10% of the real value. For example,

the contribution of forests to the GDP was mere 0.65% in 2007-08, down from 3.7% in 1970-71, 2.4% in 1981-82, 1.5% in 1991-92 and 0.96% in 2001-02 (CMIE, 2010). However, these figures exclude contribution of the forest based industries, which are included under the manufacturing sector. More importantly, these figures are based only on recorded removals from forests which are only a fraction of actual removals and do not take into account the environmental services provided by the forests. Contribution of many forest services is also perhaps recorded under agriculture rather than forestry (Saigal, 2003).

3.3.4 Low Investment in Forestry Sector

Despite the recognition by the planners of the importance of the forestry sector in Indian economy, and in growing scenario of urbanization and industrialization in the country, the investment in the forestry sector is low and inadequate. The forestry sector does not appear to be high on the government's funding priority list. The plan investment in forestry and wildlife sector so far, including State and Central plan, has been about 1% of total plan outlay (The Eleventh Five Year Plan, 2007-12). To overcome the problems faced by forests, National Forest Commission has recommended allocation of 2.5% of national budget to the forestry sector. The Planning Commission in the Eleventh Five Year Plan Mid Term Evaluation has also recommended increasing the allocation to atleast 5% of annual, State and Central sector outlay to the forestry sector preferably by the Twelfth Five Year Plan. However, the allocation for the Environment, Forests & Wildlife has remained below 1% of which Forest and wildlife sector received only 0.4% to 0.5% of overall Eleventh Plan allocation. Thus, the plan funds for the development of forest resources are inadequate to ensure the integrated management of the land and water resources in the country in a sustainable manner.

Conclusion

Forests are an important natural resource of India. They assume a great significance in Indian economy by providing a range of social, economic and ecological services. However, the present status of forests in the country is not satisfactory. It is almost a neglected sector in the structure of Indian economy. According to the ISFR 2011, the forest cover of India is 69.20 million ha. This forest cover corresponds to 21.05 % of the total geographical area of the country but falls short to the national goal (National Forest Policy 1988) of achieving 33 % of the land area under forest cover. Apart from this, out of the total forest cover of 21.05 %, only 12.3 % of forests are under dense forests, with high ecological value.

A large part of country's forest cover includes tree plantations such as agroforestry plantations, coffee and tea estates with trees, fruit orchards, coconut crops, etc. Although, these tree plantations give reflectance similar to that of forest cover, they are not actually forests and cannot perform various socio-economic and ecological functions of forests. Mathur and Sachdeva (2003) have pointed out that the ecological benefits of natural forests are difficult to replicate in man-made forests as functions like carbon-sequestration, watershed protection, etc. largely depend on topography, soil conditions and density of forests. They mentioned that while natural forests provide for all these functions, only some of these benefits may arise from man-made forests. It is also clear from an ecological definition of forests, which defines forest as "an area with a high density of trees". These plant communities cover large areas of the globe and function as carbon dioxide sinks, animal habitats, hydrologic flow modulators, and soil conservers, constituting one of the most important aspects of our biosphere" (ICFRE, 2010). Similarly, the technical glossary of the Forest Research Institute (1953) defined forests as "a plant community,

predominantly of trees and other woody vegetation, usually with a closed canopy". However, under afforestation programme in India, considerable areas were covered by planting Eucalyptus and other exotic species which are no substitute of native forests. It is reported that Eucalyptus lead to an increase in water run-off and soil loss, make the soil acidic and lower water table (Raut, 2004). Thus, the increase in the forest cover of the country in recent years may be attributed to the compositional changes in the definition of forest cover (since 2001) to include additional tree plantations as well as to the technological and methodological changes in the forest cover assessment.

Forests in India are under severe biotic pressure due to large human and livestock population. Although qualitative decline in forest cover has been arrested during the recent years, degradation of existing stock of forests is still continued. According to the report of National Forest Commission, about 41% of forest cover of the country has already been degraded and dense forests are losing their crown density and productivity continuously. The huge demand and supply gap of forest products has resulted in the unsustainable extraction of forest resources in India. Despite the regulation of diversion of forest lands for non-forestry purposes by the FCA 1980, large areas of forest lands are still being diverted for agriculture as well as for other developmental purposes. The forests are also degraded due to several other anthropogenic pressures like over and unregulated grazing, shifting cultivation and vulnerabilities to forest fires and so on. Thus, it is clear that although, the area under forests is increasing, one is not sure of the quality of the existing forest stock. Degradation of natural forests due to several factors remains a major concern of forest management.

Apart from these, insufficient database and information systems, its gross undervaluation in economic and social terms, and low investments by the Government are other major issues of India's forestry sector. Despite providing various tangible and intangible services to the economy, forests are seriously and continuously undervalued in social and economic terms. It is probably due to the lack of database and information systems on forest resources in India. As according to the World Bank (2008), the inadequate information on forests and weak monitoring capacity result in poor forest policies, planning, and management, hamper efforts to reduce illegal and unsustainable extraction of forest resources and improve transparency, and lead to undervaluation of forest resources. Such conditions, in turn, contribute to continuous decline in area, health, stock, and flows of forest resources. Thus, the availability, accessibility, consistency, reliability and quality of data and information relating to Indian forestry system are major concerns for policymakers that need to be addressed.

Chapter - 4

Environment and Forest Management in Indian Planning

ENVIRONMENT AND FOREST MANAGEMENT IN INDIAN PLANNING

At the time of India's independence in 1947, India inherited a dismal economy from the British. The colonial exploitation had left the country backward in every sphere of life. Owing to poor technological and scientific capabilities, industrialization was limited and lop-sided, agriculture was stagnant, means of transportation (except railways) and communication were underdeveloped, health and education facilities were poor and inadequate and there was high incidence of poverty with widespread unemployment. Thus, there was a need to manage the economy in a planned development framework. Besides, India's forests which were conservatively managed (on the commercial line) during the British period also demanded special attention of the planners and policymakers.

In the initial years of independence from 1947 to 1951, forests were managed under post-war development schemes which were initiated for the rehabilitation and development of forests at the end of the Second World War. Activities under post-war development schemes included development and improvement of forest roads, formation of soil conservation units, training of Forest Officers, Rangers, Foresters, etc. However, arrangements made under these schemes were on a comparatively small scale only, limited mainly by considerations of financial resources. On the contrary, more and more areas of forests were brought under State control which continued to carry on with the policy of colonial period. From 1946 to 1951, the area under State control doubled from mere 26 million hectare (mha) (65%) to 54 million hectare (79%). By1950-51, the net area under State control had increased to 68 million hectare, largely through transfer of community-owned and private forest lands to the States. However, in the privately owned forests massive felling took place due

the fear that all forests were being nationalized (Anon., 1961). Thus, during the initial years of independence, commercial exploitation of forests increased with excessive felling and denudation of forests.

However, national planning was started in the country in 1951. The First Five-Year Plan and various post-war development schemes, which were initiated for rehabilitation and development of degraded forests, were enlarged and consolidated into a National Development Plan. However, the thrust areas in these Five Year Plans kept changing according to priorities felt at that point of time. While forestry and wildlife management programmes found reflection in the national planning right from the First Five Year Plan, programmes regarding environmental protection were completely overlooked and were initiated only in the Forth Five Year Plan.

4.1 Forest Management under Five-Year Plans

The First Five-Year Plan (1951-56)

The First Five Year Plan (1951-56) put considerable emphasis on the development of forests. The aim of the Plan was to provide for the expansion and improvement of areas under forests, for meeting the increased demand for timber and forest produce in the immediate future as well as for the planning of long range development of forest resources. Besides these, revenue derived from forests was also an important consideration for which forests had to be managed. A most significant step in this direction was the enunciation of the New National Forest Policy of India in 1952, revising the old forest policy of 1894 in order to bring it into line with the requirements of the economy. The policy emphasized the protective as well as productive roles of forests and suggested, as a desirable long term objective, that one third of the land area (around 33%) should be under forests including 60% of the land

in hilly regions and 20% in the plains. Programmes of forest development in the States during the First Five-Year Plan were mainly a continuation of programmes which had been initiated under post-war development schemes during the period from 1947-51. These included schemes for afforestation and plantation, improvement of forest communications, preparation of working plans, application of modern systems of intensive forest management, introduction of modern logging techniques, demarcation of newly acquired areas with a view to their rehabilitation, improving the growing stock and strengthening of forest administration (Review of the First Five Year Plan,1957). In view of the urgent need for protecting India's rich heritage of wildlife, conservation of wildlife was considered as an integral part of forest management. Owing to this, the Indian Board for Wildlife was constituted in 1952 which has done useful work for the cause of preservation of wildlife in the country (Anon., 1961). An overall provision of Rs 7.64 crores was made in the plan (in both Centre and State budgets) for forestry and wildlife conservation programmes (Table 4.1).

The First Five Year Plan also drew attention to the important role of forests in soil conservation. Consequently, the Central Soil Conservation Board was set up by the Ministry of Food and Agriculture in 1953 with the mandate of carrying out research in soil and water conservation as well as assisting the States in carrying out soil conservation programmes. Besides expenditure on various centrally administered items, the Board sanctioned a total expenditure of Rs 47 lakh for soil conservation programmes (Review of the First Five Year Plan, 1957).

Table: 4.1- Plan-Wise Outlay[1] under Forestry and Wildlife Sectors

(in Rs Crores)

Plans	Years	Total Public Sector Outlay	Outlay for Forestry and Wildlife[1]	% of Total Outlay
First	1951-56	2069*	7.64	0.37
Second	1956-61	4800	21.21	0.44
Third	1961-66	7500	45.85	0.61
Fourth	1969-74	15901	89.42	0.56
Fifth	1974-79	38853**	208.84	0.53
Sixth	1980-85	97500	692.49	0.71
Seventh	1985-90	180000	1859.1	1.03
Eighth	1992-97	434100	4910	1.13
Ninth	1997-02	859200	8189.09	0.95
Tenth	2002-07	1525639	14344	0.94
Eleventh	2007-12	3644718	15583.02***	0.42

Source: Planning Commission Division of Ministry of Environment and Forests (MoEF), GOI.
1 Including both Centre and State provision
* 1952 Original Plan Provision
** Excludes Rs 450 crores for Hill and Tribal Areas Outlays
*** Projected/tentative provision

The Second Five Year Plan (1956-61)

The Second Five Year Plan (1956-61) aimed mainly at enlargement of the processes initiated in the First Plan and provided for the large increases in the pace of forest development. Besides continuing the work initiated during the First Five Year Plan, programmes of the Second Plan included measures for afforestation and improvement of poorer areas in the forests and extension forestry, formation of plantations of species of commercial and industrial value, promotion of methods for increased production and availability of timber and other forest produce in the immediate future, conservation of wildlife, amelioration of the conditions of staff and labour in the forests, increased volume of forest research, increased provision of technical personnel and central coordination and guidance in the implementation of forest development schemes all over the country (The Second Five Year Plan, 1956-61). A sum of Rs 21.21 crores was provided in the plan (in both Centre and State

budgets) for the development of forestry and wildlife (Table 4.1). Soil conservation work was also to be undertaken in a concentrated manner and a provision of Rs 20 crores was made in the plan for the same.

Third Five Year Plan (1961-66)

While intensifying the programmes initiated under the first two Five Year Plans, The Third Plan (1961-66) put special emphasis on measures which would help meet the long term agricultural and industrial requirements of the country and ensure more economic and efficient utilization of the available forest products including inferior timber and wood residues. The immediate objective was to increase the output through better techniques of timber extraction, to develop forest communications and to bring about increased use of preservation and seasoning processes. The plan stated that, "it is essential to develop the forest wealth of the country on a long-term basis not only for providing adequate fuel and timber for the rural areas but also for meeting the requirements of construction and various industries including paper, rayon, plywood, matches and tanning" (The Third Five Year Plan, 1961-66).

Major forest development programmes included in the plan were economic plantations for industrial and commercial purpose, plantations of quick growing species, village and extension forestry. While regarding the conservation of biodiversity as an important aspect of forest development, the plan included programmes for the development and establishment of five zoological parks, five national parks and ten wildlife sanctuaries. The plan provided an outlay of Rs 45.85 crores for various programmes of forest development in States and Union Territories including a sum of Rs 6.7 crores for Centre and centrally sponsored schemes (Table

4.1). The plan also initiated various programmes related to soil conservation and an outlay of about Rs 72 crores have been provided for their execution (The Third Five Year Plan, 1961-66).

Forth Five Year Plan (1969-74)

The Forth Five Year Plan (1969-74) had stated three main objectives in the area of forestry, namely, to increase the productivity of forests, to link up forest development with various forest based industries and to develop forests as a support to rural economy. In view of the large scale demand for timber and various forest-products for industrial purposes, the plan envisaged efforts at creating large scale plantations of valuable quick-growing species and species of economic and industrial importance. An important objective was to achieve self-sufficiency in forest products especially for major forest based industries. Accordingly, steps were proposed to bridge the gap between demand and supply by fuller utilization of forest resources other than wood such as bamboos and grasses and by encouraging the use of non-conventional woods and small-sized timber.

As far as conservation of wildlife was concerned, the plan recommended special training in ecology and conservation. Special training programmes in wildlife conservation, management and research were accordingly instituted in the Forest Research Institute at Dehradun (The Fourth Five Year Plan, 1969-74).While recognizing that protection and effective management of habitats was crucial for the conservation of the rich wildlife of the country, two new centrally-sponsored schemes- Project Tiger and Development of National Parks and Sanctuaries also came into existence in 1973 (Towards Faster and More Inclusive Growth-An Approach to the Eleventh Five Year Plan, 2006). The total outlay for forestry programmes

(including wildlife) in the Fourth Plan was Rs 89.42 crores in the Centre, States and Union Territories (Table 4.1) including a sum of Rs 1.39 crores for Centrally Sponsored Schemes (The Fourth Five Year Plan, 1969-74)

Fifth Five Year Plan (1974-79)

During the Fifth Five Year Plan (1974-79), focus shifted from conservation oriented forestry to a dynamic program of production forestry. The primary objective laid down in the Plan was to initiate measures for increasing production of industrial wood and other forest products by clear felling and creating large scale man-made forests with the help of institutional financing. The second important objective was to develop farm forestry and improvement of degraded forests to increase the fuel and timber supply in the rural areas. The major programmes of forest development included in the Fifth Five Year Plan were large scale commercial plantations, plantations of quick growing species, social forestry, forest consolidation, surveys and statistics, communications and logging. It was also proposed to build up a system of meaningful forest surveys along with a proper information system to assess the present growing stocks, increments and potential increments by forest divisions, natural regions and States. However, the Plan also drew attention towards large scale deforestation in the country and laid emphasis on intensive forest development and ensured that forest areas are not deforested for the extension of crop areas. To compensate for the forest area already lost, efforts were proposed to afforest equivalent areas out of wastelands. As far as conservation of wildlife was concerned, the plan intended to strengthen the wildlife administration on one hand and to carry out regular surveys and enumeration of various wildlife species on the other. Special efforts were proposed to protect the tiger population in nine selected areas where no commercial forestry operation would be carried out (The Fifth Five Year Plan, 1974-

79). A sum of Rs 208.84 crores were tentatively allocated in the Centre and State budgets for forestry and wildlife conservation programmes in the plan (Table 4.1).

Sixth Five Year Plan (1980-85)

The objective of forestry sector programmes laid down in the Sixth Five Year Plan (1980-85) was conservation of existing forests and launching of a country wide afforestation and social forestry programme. During the plan period, various acts were enacted and institutions were set up for the protection of environment and forests (see chapter 6). For instance, the Forest (Conservation) Act was enacted in 1980 with the main objective of checking the diversion of forest land for non- forestry purposes. Similarly, for the efficient implementation of activities in the forestry sector through modern management technologies, the Indian Institute of Forest Management was established in March 1981 at Bhopal. Moreover, Forest Survey of India (FSI) was established in June 1981 (on the recommendations of the National Commission on Agriculture) for carrying out regular surveys of forest resources of the country. While recognizing the vitality of biological organisms, the Sixth Plan laid emphasis on the protection and conservation of natural ecosystems and stated that "the preservation of the country's genetic diversity and conservation of its species and ecosystems for sustainable utilization is of crucial importance for future survival and development of our people". Accordingly, the Wildlife Institute of India was set up during the plan in 1982-83 with the objectives of building scientific knowledge on wildlife reserves, carrying out research and providing information and advice on scientific wildlife management (The Approach Paper to the Seventh Five Year Plan, 1985). A sum of Rs 692.49 crores were provided in the Plan in both Centre and State budgets for forestry and wildlife conservation programmes (Table 4.1).

Seventh Five Year Plan (1985-90)

It was for the first time during the Seventh Five Year Plan (1985-90) that the role and importance of forestry sector for economic development of the country in terms of protection of the ecosystems and supply of various forest products was understood properly. The task of bringing one-third of the geographical area of the country under tree cover became a vital need and all possible efforts were made to achieve the target. A revised National Forest Policy was formulated during the Plan in December 1988 which stressed on management of forests for conservation and meeting local communities' needs, and made commercial exploitation and revenue generation secondary objectives (Saigal, 2005). The policy also encouraged people's participation in the protection and management of forests. Thus, a decentralized system of forest management was started during the Seventh Plan with the introduction of JFM programme in 1990. The objectives and strategy laid down in the plan included conservation of ecologically fragile ecosystems and preservation of biological diversity in terms of flora and fauna, increasing substantially the vegetative cover by massive afforestation through Social Forestry, Farm Forestry and other plantation programmes, meeting the basic needs of the people in respect of fuel wood, fodder, minor forest produce and small timber, ensuring close linkages between forestry programmes and welfare of the tribal and other communities traditionally dependent upon forests, special emphasis on forestry research and education and implementation of Wildlife Action Plan for wildlife conservation (The Approach Paper to the Seventh Five Year Plan, 1985). A sum of Rs 1859.1 crores were provided in the Plan in the Centre, States and Union Territories for forestry and wildlife conservation programmes (Table 4.1).

Despite various forest conservation programmes initiated during the Seventh Five Year Plan, the scenario of forests continued to cause concern. Destruction and degradation of forests took a heavy toll of country's soil and water resources. An estimated 6000 million tonnes of top soil with essential nutrients were flowing into the sea every year. Loss of top soil, vegetative cover, unregulated surface runoff with poor recharge of aquifers seriously affected the society and in particular tribals (The Eighth Five Year Plan, 1992-97).

Eighth Five Year Plan (1992-97)

In view of these problems, the Eighth Plan also initiated various programmes and schemes regarding the protection and conservation of forests. Under forestry conservation programme, the Eighth Plan established the National Afforestation and Eco-Development Board (NAEB) in 1992. A number of afforestation schemes like Integrated Afforestation and Eco-Development Project Scheme, Fuel wood and Fodder Project Scheme, Non-Timber Forest Produce Scheme, etc were initiated under NAEB for reclaiming degraded forest areas adjoining forests. Besides, the Government of India also set up a new Department of Wastelands Development under the Ministry of Rural Development in July 1992 with the mandate to develop non forest wastelands. The plan also included the programme of Development of National Parks and Sanctuaries for Biodiversity Conservation (The Ninth Five Year Plan, 1997-02). An overall provision of Rs 4910 crores was made in the plan for forestry and wildlife conservation programmes in Centre and State budgets (Table 4.1).

Ninth Five Year Plan (1997-2002)

The Ninth Five Year Plan (1997-2002) recognized the importance of forests in maintaining ecological balance, preserving life support system on earth as well as in

achieving the goal of sustainable development. However, the shrinking forest area in the country due to the population pressure and various development activities like agriculture, irrigation, power projects, industry, roads, etc was also a matter of serious concern for the country. Thus, while showing concern on the tremendous pressure on forest resources, the Plan stressed on massive afforestation programmes, control over hacking and grazing and provision of cheap fuel through alternative technologies. A National Forestry Action Plan was also launched during the plan in 1999 to address major issues in forestry sector. The plan also laid emphasis on the conservation of biodiversity in the country. The important issues that had emerged in the Convention on Biodiversity were viewed from two perspectives-national requirement and actions and international negotiation needs, commitments and actions. The need for a comprehensive legislation had been fully recognized and the process of drafting the same had commenced. A separate biodiversity cell was also proposed to be set up in the Ministry of Environment and Forests in the Ninth Plan. The important schemes initiated during the plan for biodiversity conservation included fifty-two new research projects related with the biosphere reserves, conservation and management of mangroves and wetlands and eco-development projects in seven tiger reserves (The Ninth Five Year Plan, 1997-02). A provision of Rs 8189.09 crores was made in the Plan in Centre and State budgets for the execution of various programmes under forestry and wildlife (Table 4.1)

Tenth Five Year Plan (2002-07)

The Tenth Five Year Plan (2002-07) further emphasized on the important role of forests in achieving environmental and economic sustainability as well as in maintaining life support systems on earth. However, the plan also showed concern on consistent undervaluation of forests in economic and social terms. It was found that

despite significant resource flows and national concern, the potential of forests to reduce poverty, realize economic growth and their contribution to the local and global environment had not been fully realized. Accordingly, the Plan proposed to give a thrust to integrated forest protection which includes all components of protection and sustainable management of forests. The Approach Paper of Tenth Five Year Plan had stipulated the need to bring 25% of area under forest and tree cover by 2007 and 33% by 2012. The plan emphasized on a coordinated and balanced strategy for forest and wildlife management and rural development while integrating local community's knowledge, skills and practices into conservation strategy, planning and management. More focused interventions were required for maintaining natural forests for ecosystem protection and sustaining the global and local forest values.

The programmes related to forest protection initiated in the plan were universalization of joint forest management program, strengthening and enhancing the protected area network, effective management of protected areas, agro-forestry development, conservation and development of medicinal plants, promotion of shelter belt plantations to reduce the adverse impacts of natural calamities, improving the productivity of forest plantations, research and technology development to improve productivity and production of new products, control of poaching and illegal trade of wild animals and plant species, and development of national parks and sanctuaries, etc. A new scheme named as Protection of Wildlife outside Protected Areas (PWOPA) was also proposed for the Tenth Plan. It was also proposed to merge all afforestation programmes of National Afforestation and Eco-development Board (NAEB) into a single scheme called National Afforestation Program (NAP). This 100% Centrally Sponsored Scheme (CSS) was started in 2002-03 for regeneration and eco-development of degraded forests and adjoining areas on watershed protection and

conservation of natural resources through active involvement of people and checking land degradation, deforestation and loss of biodiversity (The Tenth Five Year Plan, 2002-07). A sum of Rs 14344 crores were provided in the Plan for the execution of various programmes under forestry and wildlife sectors in the Centre, States and Union Territories.

Eleventh Five Year Plan (2007-12)

The strategy of the Eleventh Plan for forestry sector development was to create an environment for achieving sustainable forestry and wildlife management with specific focus on the socio-economic targets. Accordingly, the plan initiated various programmes for developing forestry and improving the status of green cover. In order to meet the target of increasing forest cover by 5% of total geographical area, the plan emphasized on the rehabilitation of degraded forests through joint forest management committees by linking forests to livelihood and increasing the participatory process through National Afforestation Program. An intensive management of existing commercial plantations with scientifically designed inputs was emphasized in the plan for optimum productivity. In order to build sustainable forest management capacity of the states, two programmes of Ministry of Environment and Forests viz., Integrated Forest Protection and Strengthening Forestry Divisions were proposed to be reoriented during the Eleventh Plan. The plan has also initiated various programmes for preservation of wildlife and forest biodiversity. These include initiatives for mitigation of wildlife-human conflicts, involving and compensating local communities, management of habitats outside protected areas, rehabilitation of displaced communities and strengthening and protection of indigenous knowledge while improving research and monitoring system (The Eleventh Five Year Plan, 2007-12). A sum of Rs 15583.02 crores was tentatively

envisaged in the Plan (in Centre and State budgets) for forestry and wildlife conservation programmes (Table 4.1).

4.2 Environment Management under Five Year Plans

First Four Five Year Plans (1951-74)

While the first three Five Year Plans (1951-66) concentrated mainly on forestry and wildlife conservation programmes, it was only the Fourth Five Year Plan (1969-74) that for the first time identified the environmental consequences of development. Accordingly, the Plan articulated the need to harmonize the developmental plans with the preservation of the environment. The Plan document stated:

"...The physical environment is a dynamic, complex and inter-connected system in which any action in one part affects others. There is also the interdependence of living things and their relationships with land, air and water. Planning for harmonious development recognizes this unity of nature and man. Such planning is possible only on the basis of a comprehensive appraisal of environmental issues; particularly economic and ecological...It is necessary, therefore, to introduce the environmental aspect into our planning and development" (The Fourth Five Year Plan, 1969-74).

Fifth and Sixth Five Year Plans (1974-85)

Although, the Fifth Five Year Plan did not make any provision for environmental protection and was mainly focused on intensification of commercial forestry programmes in the country, it was the Sixth Five Year Plan which emphasized on the 'Protection of environment' for the first Five Year Plan in the national planning.

It stated that "the environment must not be considered as just another sector of national development. It should form a crucial guiding dimension for plans and programmes in each sector". The plan contained a separate chapter on environment and stated two sets of environmental problems-

1) Those arising from the conditions of poverty and underdevelopment, and

2) Those arising as negative effects of the very basis of development.

While showing concern on various environmental problems, such as land degradation, water scarcity, soil erosion, deforestation, loss of biodiversity, etc, the plan emphasized on proper and scientific management of various natural resources. The plan also expressed concern on the severity of air and water pollution in the country and stressed on the need to give greater priority to Pollution Control Boards. It proposed to adopt an integrated approach to find and implement methods of redressing existing environmental problems and build the capacity for preventing or mitigating those that could arise in future. In recognition of the need for a fresh comprehensive look at the administrative and legislative aspects of environment protection, a new Department of Environment was set up in 1981 as the 'nodal agency' for environment protection and economic development. Some of the main programmes entrusted with the Department of Environment during the plan were a strong Programme of Environmental Research and Development, Environmental Impact Assessment (EIA) of major development projects, Monitoring of Environmental Quality and setting up of an Environmental Information System (ENVIS), Programmes for increasing Public Awareness about Environmental Issues, Stimulating Public Participation in Activities for Environmental Protection, etc. A provision of Rs 40 crores was made in the Central Plan in the Science and

Technology Sector for execution of these programmes (The Sixth Five Year Plan, 1980-85).

Seventh Five Year Plan (1985-90)

The integration of environmental management in the planned development of the country was further strengthened in the Seventh Five Year Plan (1985-90). The basic approach of the plan was to harmonize sustainable development with environment. While emphasizing on the need of environmental considerations in the planning process, the plan stated that "the nation's planning for economic growth and social well-being in each sector must always take note of the need to protect environmental resources and where possible must work to secure improvement in environmental quality". In order to give greater impetus to environmental protection, conservation and ecological research and for better integration with forestry sector, a separate Ministry of Environment, Forest and Wildlife was established in 1985. A National Wasteland Development Board was set up in the same year to coordinate and monitor the development of wastelands in the country and to ensure massive afforestation with people's participation. In addition to these, the Environment (Protection) Act was passed in 1986 to empower the coordination of activities and functions of the Statutory and other agencies in the field of environmental protection at the Centre and State levels (Mid-Term Appraisal of the Seventh Five Year Plan, 1988).

In addition to these, the environmental programmes which were undertaken during the Sixth Plan period were intended to receive greater impetus in terms of investment and implementation strategies during the Seventh Five-Year Plan. These included Pollution Monitoring and Control Programme, Environment Impact

Assessment (EIA), Natural Living Resources Conservation Programme, Environment Research and Development Projects, Environmental Awareness Programme and Eco-development Programme. Major activities undertaken by Central Pollution Control Board (CPCB) for the control and abatement of pollution in the plan were development of laboratories, management and operation of national air and water quality network, controlling pollution at sources, programmes on waste recycling, prevention of coastal pollution, etc. Apart from these, the Ganga Action Plan (GAP) Phase-I was launched by the Government of India in 1985 as a 100 % Centrally Sponsored Scheme with the objective of improving the water quality of river Ganga (The Seventh Five Year Plan, 1985-90).

Eighth Five Year Plan (1992-97)

Concern over degradation of environment and forests was also brought out in the Eighth Five Year Plan (1992-97). It was noted that many environmental problems were continuing to cause serious concern, for example, the loss of top soil and vegetative cover, the degradation of forests, continuing pollution by toxic substances, inappropriate agricultural and industrial practices and unplanned urban growth. The plan also acknowledged that environmental degradation was seriously threatening the economic and social progress of the country. Finally, the Plan suggested eight major tasks for meeting these challenges:

1. To protect the natural environment.
2. To regenerate and restore degraded ecosystems and increase their productivity and to generate employment through these activities.
3. To decentralize control over nature and natural resources.
4. To develop and disseminate an understanding of nature and natural processes.

5. To formulate a National Policy for environment and design an appropriate institutional and legal framework in support of the policy.

6. To ensure coordinated and integrated government action aimed at conserving nature and making sustainable use of natural resources.

7. To make individuals and institutions more accountable for any actions impinging on the environment and the ecosystem.

8. To monitor the state of environment (The Ninth Five Year Plan, 1997-02).

In order to enhance effective regulatory measures for the protection of environment and conservation of natural resources, the government brought out the National Conservation Strategy and Policy Statement for the Abatement of Pollution (A Mid-Term Appraisal of the Eighth Five Year Plan, 1995). A Policy Statement on Environment and Development was also laid down in the plan for better integration between environment and developmental activities. Besides these, a number of pollution control programmes have been launched during the plan. Major activities of Central Pollution Control Board (CPCB) included in the plan were development and expansion of laboratory facility, management and operation of the national air and water quality network, controlling pollution at sources, evaluation and implementation of national standards, hazardous waste management, development of criteria for eco-labeling of consumer products, remedial measures for vehicular pollution in metro cities, noise pollution survey and organizing nation wide awareness programmes for prevention and control of pollution. Other pollution control programmes included in the plan were Submission of an Environmental Statement by the polluting unit to the concerned State Pollution Control Board (SPCB) for waste reduction, Adoption of Clean Technologies in Small Scale Industries, World Bank

Assisted Industrial Pollution Prevention Project (Phase-I & II), Pollution Monitoring and Review, etc. Apart from these, the Ganga Action Plan Phase-II (GAP-II) and National River Conservation Plan (NRCP) were also approved during the plan as Centrally Sponsored Schemes. Later, the GAP-II was merged with NRCP through a government resolution in 1996.

A new feature of the Eighth Five Year Plan was the adoption of market based economic instruments by the Government of India to integrate economic and environmental planning. This includes enhancing the cess rates on water consumption, duty concessions, accelerated depreciation on pollution abatement equipments, etc. A new scheme named as 'Paryavaran Vahini' on environmental information dissemination was launched during the Eighth Plan to ensure public participation in the programmes of environmental awareness generation, control of pollution and conservation of natural resources (The Ninth Five Year Plan, 1997-02).

Ninth Five Year Plan (1997-2002)

The Ninth Five Year Plan (1997-2002) also gave considerable importance to the protection of the environment in its development strategy. The Government of India's Policy towards environment was guided by the principles of Agenda 21, which was adopted at the Earth Summit at Rio de Janeiro in June 1992. It aimed at integrating environmental imperatives with developmental aspirations. The principles of Agenda 21 found reflection in the policy statements of the Government of India on forestry, abatement of pollution, national conservation strategy and environment and development. With regard to the social and economic dimensions of Agenda 21, India became a signatory to the Montreal Protocol for phasing out ozone depleting substances, the Basel Convention on trans-boundary hazardous substances, the

Convention on Biological Diversity and other international treaties. The plan considered it essential to safeguard country's interests in these negotiations for meeting the challenges at the national and international levels. One of the objectives of the Ninth Five Year Plan was to ensure environmental sustainability of the development process through social mobilization and participation of people at all levels.

The strategy for environment in the Ninth Plan was based on the belief that macro-economic stability is fundamental not only for economic growth but also for sound environmental management. The plan envisaged a multi-pronged strategy for sustainable development of the country. It chalked out issue-specific programmes, area-specific programmes and sector-specific programmes. The core items of these programmes comprised involvement of people, strengthening of the surveillance and monitoring system, preparation of state of environment reports at all levels, graduation from environmental impact assessment to economic impact assessment, introduction of valuation and environmental economics and natural resource accounting. Pollution control measures initiated in the Ninth Plan include approval of National Lake Conservation Plan as a 100% centrally funded scheme with the objective of restoring the polluted and degraded lakes of the country. Besides, by considering energy sector a major polluter, the plan initiated a number of steps to minimize its adverse impact on environment (The Ninth Five Year Plan, 1997-02).

Tenth Five Year Plan (2002-07)

The Tenth Five Year Plan (2002-07) emphasized both economic and environmental sustainability in the process of development. Sustainability was regarded as an imperative rather than an option without which, it was believed that

environmental deterioration and economic decline will be feeding on each other leading to poverty, pollution, poor health, political upheaval and unrest. Under environmental quality monitoring program, the plan has initiated a number of measures to control air and water pollution. All major rivers were targeted to be cleared by 2007. A program for real time air quality monitoring for cities with population of more than 1 million was also started during the plan. In addition to these, the plan introduced some new schemes with international cooperation under eco-restoration, watershed management, water and energy sectors, biodiversity, climate change, ozone layer protection, land degradation, etc. (The Tenth Five Year Plan, 2002-07). The Tenth Plan was also a period of extensive review of environmental processes and law. The first National Environmental Policy was put into place in May 2006 with the important objective of mainstreaming environmental concerns in all developmental activities. Also the re-engineering of the environmental clearance process and Environmental Impact Assessment were undertaken to improve the quality of environmental governance (MoEF, 2006b).

Eleventh Five Year Plan (2007-12)

The Eleventh Five Year Plan (2007-12) regarded the protection of environment as a central part of any sustainable inclusive growth strategy. The plan stated that the environmental objectives can only be achieved if environmental concerns are internalized in policymaking in all sectors of the economy- infrastructure, transport, water supply, sanitation, industry, agriculture and anti-poverty programmes. It also calls for strengthening the regulatory framework for environmental management so that development decisions do not impinge adversely on sustainability. Accordingly, it emphasized on the need for setting up of an independent statutory body on sustainable development with the specific responsibility of guiding government

policies and programmes for making them more socially and environmentally sustainable. Restructuring of State Pollution Control Boards (SPCB) into statutory Environment Protection Authorities was also regarded necessary for the same. Environmental Impact Assessment (EIA) was considered as an important management tool for integrating environmental concerns in the development process and for improved decision making (MoEF, 2006b). The monitorable targets of the Eleventh Plan for environmental protection were to-

1. Increase forest and tree cover by 5 percentage points.
2. Attain WHO standards of air quality in all major cities by 2011-12.
3. Treat all urban waste water by 2011-12 to clean river water.
4. Increase energy efficiency by 20 percentage points by 2016-17 (Mid-Term Appraisal of the Eleventh Plan, 2007-12).

4.3 Assessment of Programmes and Schemes Initiated in the Plans

Both the First and Second Five Year Plans made a significant progress in terms of various schemes initiated in the plans. About 0.52 lakh hectares of area in the First Plan and 3.11 lakh hectares in the Second Plan were afforested with the expenditure of Rs 1.28 crores and 6.86 crores respectively (Table 4.2). A considerable area (over 20 million acres) of forest land under private ownership was brought under State control and the administrative set up was strengthened to deal with this additional responsibility. The preparation of working plans was speeded up and additional areas were brought under working plans (The Second Five Year Plan, 1956-61). A significant step towards forest management in the First Plan was the adoption of the revised Forest Policy in 1952. The Policy emphasized on both productive as well as protective functions of forests. However, no apparent attempt

had been made for the protection of forests. Rather, the policy was initiated to allow exclusive state control over forest management (Murali *et.al*, 2003). Until the end of the Second Five Year Plan (i.e., 1961), forest management was continued along the lines of the traditional sustained yield method implemented under colonial rule. Although forest operations were intensified, demand for pulp and wood expanded rapidly as the government (while upholding its exclusive control over forests) encouraged and subsidized forest based industries (Faust, 1996). This resulted in shortfalls in the supply of various forest produces.

In an effort to make up these shortfalls, forestry operations were further intensified during the Third Five Year Plan. The objective was to raise productivity progressively and to undertake cultivation of quick growing species so as to meet the growing industrial and commercial requirements of the country. Accordingly, the plan included a vigorous programme of commercial plantations. Quick growing species of trees were planted in an area of about 246,000 hectares to meet the requirements of pulp and paper industries during the plan. About 5.83 lakh hectares of total area was afforested in the plan with the expenditure of Rs 21.13 crores (Table 4.2). Moreover, about 30,000 square kilometers were covered in nine states under a new scheme of pre-investment survey of forest resources with UNDP (United Nations Development Programme) assistance. The survey gave information relating to overall resources of forest species available in particular areas along with the feasibility of their economic exploitation. To increase the output through better techniques of timber extraction, training was given in the basic use of logging tools to a number of forest officers with the help of experts from United Nations (The Fourth Five Year Plan, 1969-74). Thus, in the first three Five Year Plans, there were no concrete steps for the protection of

environment. Only few scattered forestry and soil conservation programmes were undertaken.

The Fourth Five Year Plan (1969-74) for the first time clearly articulated the need to harmonize the developmental plans with the preservation of the environment. However, the programmes initiated in the Plan gave no new strength to environmental concern. The focus was still on maintaining productive function of forests. Although the area afforested in the plan had increased to 7.14 lakh as against 5.83 lakh hectares in the previous plan (Table 4.2), the afforestation done in the plan was still dominated by the plantations of quick growing species (over 2.51 lakh hectares) and the economic plantations of industrial and commercial uses (over 2.89 lakhs hectares) constituted together about 76 % of total area afforested during the plan (The Fifth Five Year Plan, 1974-79). Faust (1996) has reported that "the strategy implemented in the Fourth Plan saw the Central Government using financial incentives to encourage State Governments to practice production forestry. In practice, this involved clear felling of existing mixed forests and replacing them with monoculture plantations of fast-growing commercial species such as eucalyptus and tropical pines". This obviously had a negative impact on forests and wildlife as well as on the people dependent on these natural forests.

In 1970, a National Commission on Agriculture (NCA) was appointed and forestry was among the subjects put under its purview. The report submitted by the Commission in 1976 noted that forests occupied 23 % of India's land, but their contribution to the National Product was less than 1 percent. It concluded that mixed plantations had no commercial value (Murali *et al.*, 2003). Thus, a forestry programme based on aggressive production was started. It earmarked 45 million hectares for clear-felling existing forests and replacing them with quick growing

species. The report also recommended the formation of autonomous State Forest Development Corporations to enhance flexibility for commercial operations and suggested institutional financing. These recommendations provided the major thrust of forestry in the Fifth Plan (Faust, 1996). However, Lal (1992) was critical of these Forest Development Corporations. He argued that "they often felled good quality mixed forests and replanted them with monocultures of economic species such as teak, eucalyptus, etc., subordinating both ecological and survival needs for short-term economic gain". Thus, the period of the Fifth Plan (1974-79) was characterized by the intensification of commercial forestry. Large tracts of natural forests were converted to meet the growing industrial demand of the country.

While criticizing the government policies regarding forestry and wildlife conservation during the first five National Developmental Plans, Sixth Plan document stated that the forests under management have, moreover, been treated from the very narrow viewpoint of production of commercial timber and pulpwood so that they have been rapidly converted to stands of teak, pine or eucalyptus with no thought given for even the maintenance of species producing valuable minor forest produce such as oilseeds. Besides, the wildlife conservation efforts have so far been primarily directed to the maintenance of areas with one or more spectacular animals such as the Tiger or the Rhino. This led to the total neglect of many other ecosystems which lacked such spectacular animals but were rich in floristic reserves (The Sixth Five Year Plan, 1980-85).

It was for the first time during the Sixth Five Year Plan that the concern for environmental protection, which was almost overlooked during the first five National Developmental Plans, was regarded as the very basis of development. Separate steps were undertaken for water, air, noise and land pollutions. Though plans and

programmes in the field of soil conservation, forest and wildlife protection, industrial hygiene, etc. had been in existence in India for many decades, but the first formal recognition of the need for integrating environment into developmental planning was made during this plan. Apart from various programmes for environmental protection, the plan initiated large scale afforestation under Social Forestry Programme resulting in afforestation of about 46.50 lakh hectares of total area with the expenditure of Rs 926.01 crores (Table 4.2). However, the Social Forestry Programme failed to meet its objective of involving local people and meeting their subsistence needs. Rather the plantations raised under the programme were dominated by monocultures of exotic species such as Eucalyptus and Acacia (Murali, *et al.,* 2003). This led to the loss of biodiversity and degradation of natural forests.

During the Seventh Five Year Plan, environmental management was accepted as a major guiding factor for national development. The plan initiated a number of programmes for the protection and conservation of environment and forests. A significant progress was made in environment and ecology, forestry and wildlife and wastelands development. Under Pollution Monitoring and Control Programme, a number of air and water quality monitoring and coastal monitoring stations have been established. Fourteen river basins of the country were monitored to control water pollution. However, out of total 261 schemes sanctioned under Ganga Action Plan, Phase-I (GAP-I) during the plan, only 147 could be completed. Under Environment Impact Assessment (EIA) Programme, about 1464 development projects were appraised in the areas of river valley, mining and thermal power industries. Besides, under wildlife conservation programme, seven Biosphere Reserves were set up for preserving the genetic biodiversity apart from ecological restoration in fragile areas (The Eighth Five Year Plan, 1992-97).

Afforestation programmes also progressed well during the plan. The coverage area of afforestation in the plan had increased to 8.87 million hectares as against 4.65 million hectares in the Sixth Plan (Table 4.2). The National Wasteland Development Board was set up during the plan to bring about qualitative changes in the programme on one hand and to secure people's participation on the other. However, an evaluation carried out by the Programme Evaluation Organization (PEO) of the Planning Commission indicated that people's participation under this programme had been very limited and the trees planted were of species which met the requirements of wood for urban market rather than the subsistence needs of the rural poor. Similarly, under Social Forestry Programme, the efforts had largely been departmental. The rural poor and tribal population which depends mostly on forests for their survival were given restricted access to the areas which were taken up for development. However, the National Forest Policy 1988 initiated during the plan marked a major departure from the past policies and almost reversed the objectives of forest management in the country by giving priority to the protection and conservation of forests over revenue orientation. Joint Forest Management was regarded as the implementing mechanism for the policy prescriptions (Balooni, 2002).

During the Eighth Five Year Plan (1992-97), a lot of work had been done for the protection of environment. Under pollution control programmes, thrust was given to the management of hazardous wastes, adoption of clean technologies by industries, etc. GAP-I, initiated during the Seventh Plan was still continued. Under this scheme, out of 261 schemes of pollution abatement taken up in 25 class-I cities along the river Ganga, 254 schemes were completed till March, 1998. The programme was delayed due to the land acquisition related litigation and contractual issues. Two new centrally sponsored schemes namely, GAP-II and National River Conservation Programme

(NRCP) were also approved during the plan for sewage treatment (The Eighth Five Year Plan, 1992-07). Under GAP-II, works on the major polluted tributaries of Ganga, namely, Yamuna, Gomati and Damodar, were taken up with the objective of improving the river water quality, as per the designated best use criteria.

In the forestry sector, Joint Forest Management (JFM) was regarded as the principle element of forest management strategies in the country, with a primary focus on protection and conservation goals. The programme became the central point of future forest development projects funded by the Government of India and the donor agencies. By 1997, 18 State governments had issued enabling resolutions, permitting partnerships with local people. These States had 80% of the country's forest land and 92% of its tribal population. However, the total area afforested during the plan under various plantation programmes went down to 79.50 lakh hectares against 88.63 lakh hectares in the Seventh Plan (Table 4.2). The JFM programme often failed to give attention to the poorest forest dependent communities such as artisans, head loaders, shifting cultivators, etc. (Mid-Term Appraisal of the Ninth Plan, 2000).

The Ninth Plan also included a number of programmes regarding environment and forest protection. The Central Pollution Control Board (CPCB) was provided with an outlay of Rs 32 crores for undertaking various pollution control measures like environmental monitoring, assessment of pollution, environmental standards and action plan, enforcement of pollution abatement programme, promotion of infrastructure and capacity upgradation programmes, etc. Ganga Action Plan, Phase-I & II, National River Conservation Plan (NRCP) and National Lake Conservation Plan (NLCP) were the principle water quality improvement schemes in the plan. However, these schemes largely failed to provide required results. For instance, the GAP-I, initiated in 1985 in the Seventh Plan and was expected to be completed within the five

years of the plan, continued into its 15th year (i.e. 2000). The time and cost over-runs have been contributed to the fact that such a scheme was taken up for the first time in the country without any preparatory work in project formulation and planning. Also, the States have been taking a lukewarm interest in its implementation. In the Ninth Plan, this scheme had been converted from 50:50 sharing Centrally Sponsored Scheme (CSS) into a 100 % CSS. In spite of this, assets created were not being adequately utilized because of lack of operation and maintenance funds. Progress of other River Action Plans was equally slack primarily because of slow preparation of Detailed Project Reports (DPRs) by the State Governments and withholding of Central Government Funds from executing agencies.

The JFM Programme progressed satisfactorily; however, its legal framework remained weak and controversial. About 80.50 lakh hectares of total area was afforested during the plan under various afforestation programmes (Table 4.2). Under wildlife conservation programme, although, the number of Protected Areas (PAs) had increased, the status of most of these areas was somewhat unsatisfactory vis-à-vis biodiversity conservation. Only 40% of National Parks and 16% of Wildlife Sanctuaries had completed their legal procedures. Moreover, these were under intense pressure from human population living within and around them (Mid-Term Appraisal of the Ninth Plan, 2000).

The Tenth Plan was mainly a continuation of some previous projects with some new initiatives. The plan targeted cleaning of major polluted rivers by 2007 and other notified stretches by 2012. In this direction, a fairly large capacity was created under GAP-II/ NRCP for sewage treatment, which covered 160 towns along the polluted stretches of 34 rivers in 20 states and created 2055 MLD of sewage treatment plant (STP) capacity till 2007. However, no precise estimates are available on the

proper utilization of this installed capacity. The average capacity utilization of existing STP capacity was reported to be about 72% against the desired capacity of 100%. This under-utilization of capacity was due to the factors like irregular power supply, absence of connections between domestic sewage drains and STPs, failure of States to provide for maintenance costs of STPs, and so on. Although, some improvements in water quality were achieved, the results were not up to the required standard, primarily due to increased sewage inflow. For instance, the water quality of Yamuna at Delhi and some other major rivers remained well below the standard.

In order to improve the quality of air, a programme for real time air quality monitoring for cities with population of more than 1 million was started during the plan. As many as 76 cities/ towns were found to exceed acceptable limits, mainly due to vehicular and industrial pollution (The Eleventh Five Year Plan, 2007-12).

In the forestry sector, the plan envisaged an increase in quantitative target of Forest and Tree Cover (FTC) to 25 % by 2007 and 33 % by 2012. Consequently, thrust was given to various afforestation programmes under the plan. The plan proposed universalization of Joint Forest Management (JFM) programme. By 2005, about 99708 JFM Committees were formed in the 1.70 lakh villages in the vicinity of forests against about 62890 at the beginning of the Tenth Plan (Anon, 2006). The NAP, which was regarded as the main vehicle for achieving the target of increasing forest and tree cover, also yielded excellent results in empowering local communities and development of forests. However, no specific study was undertaken by the Ministry of Environment and Forests to access the increase in forest cover as a result of implementation of NAP (Gupta, 2009).

4.4 Forest Plantations and its Impact on Forest Cover

One of the important objective in the forestry sector during the planning period was to enhance the status of green (forest/tree) cover in the country so that the national goal of 33% forest and tree cover could be achieved besides producing wood and other products for meeting the needs of society and wood based industries. Thus, the forestry plantations constituted an important component of the five-year development plans in the country since the beginning of the First Five Year Plan in 1951. Accordingly, a number of afforestation programmes (agro-forestry, farm forestry, social forestry, Joint Forest Management) were launched and area afforested under these programmes through successive plans has increased substantially. It is evident from Table 5.2 that area under forest plantations has increased from a mere 0.52 lakh hectares in the First Plan and 12.21 lakh hectares in the Fifth Plan to 88.63 lakh hectares in the Seventh Five Year Plan. However, the area has dropped to 79.50 lakh hectares and 80.50 lakh hectares during the Eighth and the Ninth Five Year Plans respectively, it is still significant.

It was believed that these plantations will add to the forest cover to increase its extent in proportionate manner. However, it is not known with certainty that how accurately they have been assessed? In this context, Mukherji (2004) has pointed out that estimates of afforestation are often imprecise because they are based on the number of seedlings distributed rather than those actually planted and survived. It is also to be noted that all plantations do not survive. Survival rates of seedlings have been variable due to the poor quality of planting material and care and protection offered after planning. Besides, some plantations are raised in degraded forests to improve the stocking, which would not result in a net increase of forest cover but will only improve the density of the forest class. There is also some fake reporting of

plantation to meet the targets. Some of the fast growing, short rotation species are clear felled and planted. Due to lack of proper accounting of these details, the accurate area of existing forest plantations by species, age, class, locations at any reference year is uncertain and their exact contribution to forest cover is not known (FSI, 2005).

Table: 4.2- Trends in Area Afforested and Expenditure Incurred from 1951-2006

(Area in lakh hectares; Expenditure in crores rupees)

Plan Period	Area afforested during the plan period	Expenditure in plan period
First Plan (1951-56)	0.52	1.28
Second Plan (1956-61)	3.11	6.86
Third Plan (1961-66)	5.83	21.13
Three Annual Plans (1966-69)	4.53	23.02
Fourth Plan (1969-74)	7.14	44.34
Fifth Plan (1974-79)	12.21	107.28
Annual plan (1979-80)	2.22	37.10
Sixth Plan (1980-85)	46.50	926.01
Seventh Plan (1985-90)	88.63	2426.63
Annual Plan (1990-91)	13.87	627.79
Annual Plan (1991-92)	17.25	705.72
Eighth Plan (1992-97)	79.50	3686.40
Ninth Plan (1997-02)	80.50	7350.50#
2002-03	11.36	170.49*
2003-04	12.25	225.53*
2004-05	15.80	237.90*
2005-06	19.99	249.51*

Source: National Afforestation and Eco-Development Board (NAEB) of MoEF, Government of India.
Figures of Allocation.
* Funds are allocated by MoEF under National Afforestation Programme Scheme for afforestation on degraded lands.

Conclusion

It was found that conservation and protection of environment and forests was included in the economic planning of the country. The environmental problems which received government attention were land degradation, soil erosion, deforestation, loss

of biodiversity, water scarcity, water and air pollution, etc. Accordingly, various programmes and schemes were initiated and a number of institutions and boards were set up by the government to address these issues. However, despite these efforts, the degradation of environment and forests is continued in the country due to ineffective implementation of various policies and programmes. The Indian forests have been shrinking for several decades due to the imbalance between productivity of forests and exploitation of forest produce. In fact, population pressure and poverty as well as growing demand for forest based inputs for industrial use and other developmental projects like irrigation and power projects have resulted in continuous deterioration in the forest cover of the country.

It was also observed that forests of the country did not get its due share in the outlays of various national development plans. As it is evident from Table 5.2, that though the share of forestry and wildlife sectors to the total plan outlay has increased substantially through the successive plans, it remained below 1% till Sixth Five Year Plan. It was only in the Seventh Plan, the allocation under forestry and wildlife sectors increased above 1%. However, after crossing the 1% barrier in the Seventh (1.03%) and Eighth (1.13%) Plans, it again slipped to below this level in the Ninth (0.95%) and Tenth (0.94%) Five Year Plans. The main reason of low allocation to the sector is the fact that forestry has neither gained the importance, it deserves, nor does it attract the political commitment. Financial resources are limited in the country and there is competing demand from sectors such as Power, Transport, Rural development, etc. Undervaluation of the contribution of forests to GDP, which is presently estimated as 1.2% is another reason of inadequate financial support. However, in order to overcome the problems faced by forests, National Forest Commission (2006) has recommended allocation of 2.5% of national budget to the forestry sector.

Chapter - 5

Policy and Legal Framework for Environment and Forest Management in India

POLICY AND LEGAL FRAMEWORK FOR ENVIRONMENT AND FOREST MANAGEMENT IN INDIA

Environment plays a pivotal role in human life as well as in the development of a country. However, with growing technological advancement and industrialization, the purity of the environment has been threatened to an appalling extent. Due to large scale occurrence of environmental crises, the global community has expressed major concern over environmental protection. In the backdrop of some sincere efforts of tackling pollution control, the attention of the world was drawn, for the first time, towards environment in the United Nations Conference on Human Environment, held at Stockholm in June 1972. The Declaration on Human Environment, containing twenty-six principles, was passed with the main objective of overcoming environmental problems related to the development of States and to provide clean & healthy living conditions (Palmer, 1995).

An important aspect of the Stockholm Declaration was a strategy to draft an action plan for the controlling and regulating environmental degradation. The declaration stated that the protection and improvement of human environment is a major issue which affects the well-being of people and economic development throughout the world and it is the duty of all governments to exert common efforts for the preservation and improvement of human environment, for the benefit of all people and their prosperity (Paul, 1987). The declaration further stated that economic and social developments are necessary for ensuring a healthy environment for man. This, in turn, has been called the 'Magna Carta on Environment' from which two important conclusions can be reached: (i) Man has the Fundamental Right to Freedom, Equality and dequate conditions of life in an environmental quality that permits a life of dignity

and well-being; and (ii) Man bears a solemn responsibility to protect and improve the environment for present and future generations (Bajwa and Bains, 1987).

Apart from this, the most revolutionary step towards the preservation of the environment was the Earth Summit convened by the United Nations General Assembly at Rio de Janeiro in 1992. The Conference saw the largest gathering of the world leaders ever in the history, deliberating and chalking out a blue print for the survival of the planet. It added a new dimension on the issues of environment and development in the international negotiations. The main objective of the Summit was to find an equitable balance between the economic, social and environmental needs of present and future generations and to lay down a foundation for global partnership between developed and developing countries. The Conference also enunciated the use of market principle in framing of economic instruments and policies to pursue sustainable development. Amongst the tangible achievements of the Rio Conference was the signing of the two conventions, one on biological diversity (Convention on Biological Diversity) and another on climate change (United Nations Framework Convention on Climate Change) (McCarthy, 1993).

Both the Stockholm Conference 1972 and Earth Summit 1992 have influenced environmental policies and regulations in most countries, including India. Many countries and international agencies have accepted the 'polluter pays principle', the 'precautionary principle' and the 'concept of intergenerational equity' as guidelines for designing environmental policies (Sankar, 1998). Ever since the Stockholm Conference, 1972 proclaimed the right of people to a clean environment, a number of measures to curb the menace of pollution have been undertaken in different parts of the world. The Conference also exerted influence on environmental legislations in India. A National Committee on Environmental Planning and Coordination (NCEPC)

was set up in the Department of Science and Technology in 1972 to make necessary preparations for the Conference. This Committee later evolved into a full-fledged Ministry of Environment and Forests (MoEF) in 1985 which today is the apex administrative body in the country for regulating and ensuring environmental protection. The Government of India took a number of steps to implement the decisions taken at the Conference by means of amendments to the Constitution, new legislations relating to environmental protection and creation of institutions for implementing the legislations. Two major Acts- the Wildlife (Protection) Act 1972 and the Water (Prevention and Control of Pollution) Act 1974 were enacted by the Parliament of India. Besides, the new Fundamental Rights and Duties of Citizens were added to the Constitution. The provisions made in Article 48-A and 51-A of the Constitution by the 42nd Amendment in 1976 give directions to the State for the protection of environment (Article 48-A) and also imposes duty on every citizen to help the preservation of natural environment (Article 51-A). Armed with these Constitutional provisions, the Parliament enacted the Forest (Conservation) Act in 1980 and the Air (Prevention and Control of Pollution) Act in 1981. Institutions like Central and State Pollution Control Boards were also created for implementing the provisions of the Acts. The Bhopal gas tragedy in 1984 resulted in the passage of a comprehensive environment legislation *viz.*, the Environment (Protection) Act in 1986. Later, two important acts related with the handling of hazardous substances- the Public Liability Insurance Act, 1991 and the National Environment Tribunal Act, 1995, were also passed. Constitutional Amendments (73rd and 74th) were made in 1992 to facilitate devolution of powers and resources to local bodies.

A policy framework has also been developed to complement the legislative provisions. The Policy Statement for Abatement of Pollution (PSAP) and the National

Conservation Strategy and Policy Statement on Environment and Development (NCS-PSED) were brought out by the MoEF in 1992 to develop and promote initiatives for the protection and improvement of the environment. The PSAP advocated the need for combining regulatory instruments with market-based instruments and various supportive measures to deal with environmental protection. It recommended the polluter pays principle, involvement of the public in decision making and new approaches for market choices 'to give industries and consumers clear signals about the cost of using environmental and natural resources' (MoEF, 2006). Besides, in order to give an effect to the provisions laid down in the Convention on Biological Diversity in 1992, the Biological Diversity Act was enacted by the Government of India in 2002. Later, in 2006, the Parliament of India also enacted the Forest Rights Act to address the issues related with the forest dwellers as well as for the management and conservation of forests with the help of these people.

5.1 Environmental Regulation in India

5.1.1 Pre Independence period

The environmental regulation in India has a fairly long history. The scriptures and codes constituted the basis for the law and the state policy in the ancient past. During this period, the regulation of people's use of natural resources (especially forests) was done through local customs Mukherji (1994). However, these regulatory customs were restrained during the British rule in India. A number of legislative and regulatory measures for the protection and conservation of environment and forests were initiated during this period especially to control pollution of different segments of environment as well for the protection of forests and wildlife in the country. The Shore Nuisance (Bombay and Kolaba) Act 1853, the Oriental Gas Company Act

1857, the Bengal Smoke Nuisance Act of 1905 and the Bombay Smoke Nuisance Act of 1912 were the earlier laws concerning air and water pollution during the British period (MoEF, 2006).

The Indian Penal Code (IPC) enacted in 1860 also included various provisions for the regulation of air and water pollution. For instance, Section 277 of IPC imposes a fine on a person who voluntarily fouls the water of any public spring or reservoir. Section 278 lays fine on person who voluntarily vitiates the atmosphere so as to make it noxious to the health of people. Sections 284, 285 and 286 deal with negligent conduct with respect to poisonous substances, combustible matter and explosive substances respectively. Sections 428 and 429 cover mischief to animals (Mandal and Rao, 2005).

Besides these, laws also existed for the protection of forests and wildlife. The first Indian Forest Act was drafted in 1865, placing most forests under State ownership. It was further revised in 1878 and consolidated in 1927. The Act facilitated the State's grip over forests and consequently communities were deprived of many of their traditional rights over forests (Balooni, 2002). The main objective was to control areas, where the State could carry out revenue generation through "scientific forestry", which very often meant outright or gradual replacement of the indigenous forests by the commercially useful species (Pathak and Kothari, 1998). Thus, the Acts, being the product of the British colonial days, reflect the exploitative intentions of colonial and feudal society of the time rather than the environmental and ecological interests to preserve the forests.

In the field of wildlife protection, early legislation was limited to specific areas and particular species. In 1873, Madras enacted the first wildlife statute for the

protection of wild elephants. The first effort by the Central Government came six years later with the passing of the Elephants Preservation Act of 1879. In 1912, the Central Government enacted a broader Wild Birds and Animals Protection Act. Extending to most of British India, this law specified closed hunting seasons and regulated the hunting of designated species through licenses. The first comprehensive law for the protection of wildlife and its habitat was perhaps the Hailey National Park Act of 1936, which established the Hailey (now Corbett) National Park in the State of Uttar Pradesh (now situated in Uttarakhand). Indeed, all the statutes related primarily to the regulation of hunting and did not regulate trade in wildlife and wildlife products. As a consequence, wildlife degradation continued and many species became extinct (Rosencranz, 1991).

It is clear from the above description that numerous legislative measures were taken by the British Government for prevention of pollution and for conservation of natural resources. However, Rozencranz (1991) view that the British enacted these legislations, not with the objective of protecting the environment but with the aim of earning revenue for themselves. On the contrary, Leelakrishnan (1999) has pointed out that laws initiated during the British period have provided a base and have contributed significantly to the growth of environmental jurisprudence in India. They argued that although these efforts had been undertaken for commercial motives, they should be regarded as the first step towards the scientific conservation of natural resources.

5.1.2 Post Independence Period

In the early years of India's independence, there was no precise environmental policy and regulation. The Indian Constitution did not make any direct reference to

environmental protection. The dominant policy objectives during this period were economic growth, employment generation, balanced regional development and equity. Environmental considerations did not play a major role in policy making.

5.1.2.1 Constitutional Provisions

Although initially, the Constitution of India had no direct provision for protection of environment. Perhaps, the framers of Indian Constitution, at that time, thought it a negligible issue that is why it did not even contain the expression "environment".

However, by taking note of Stockholm Conference 1972 and with growing awareness of the environmental crises, provisions for environment were added into the Constitution by the 42nd Amendment Act in 1976. Through this Amendment, specific provisions were inserted into the Directive Principles of the State Policy and Fundamental Duties.

Article 48A which was added to the Directive Principles of the State Policy provides that "...the State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country". The article imposes an obligation on the State (including Courts) to protect the environment. Article 51A (g) in a chapter entitled, "Fundamental Duties", imposes a similar responsibility on every citizen. It says that every citizen shall have the duty "to protect and improve natural environment including forests, rivers, lakes and wild life and to have compassion for living creatures" (Nomani, 2004).

The Constitution, thus, makes two-fold provisions. On one hand, it gives directive to the State for protection and improvement of environment and on the other, it imposes a duty on every citizen to help in preservation of natural environment.

Together these two provisions lay the foundation for jurisprudence of environmental protection in India. These provisions are indicative of the Government's awareness of a contemporary problem and of the need for providing a constitutional base for further action at the national, State and local levels (Kaur, 1987). The Directive Principles are a policy prescription to be followed by the Government. Although not justifiable in the court of law, the Directive Principles are increasingly being cited by Judges as complementary to the Fundamental Rights (Chatterjee, 2007).

Despite the fact that the new provisions added to the Constitution of India by the 42nd Amendment carry the spirit of Indian philosophy of respect towards environment, they have been criticized by some authors as these provisions proved to be ineffective. According to Sunitha (2008) "the Directive Principles which act as a model and guidance for the state in making laws for the welfare of citizen do not give any justifiable right, unlike Fundamental Rights which can be exercised through judiciary. The Fundamental Duties are an appeal to the citizens and do not have any compliance force.

Fundamental Rights and Environmental Protection

The Supreme Court of India has expanded the boundaries of the Fundamental Right to life and personal liberty guaranteed in Article 21 so as to include environmental protection. The Court held that the Fundamental Right of protection of life and personal liberty envisaged under this article embraces not only physical existence of life but also quality of life. The Article 21 of the Constitution states that "No person shall be deprived of his life or personal liberty except according to procedure established by law". Similarly, Article 32 of the Constitution of India speaks that a citizen has the right to have clean air and water (Nomani, 2004). The

Judiciary in India began to recognize the right to clean environment as part and parcel of Fundamental Right. "The right to clean water and the right to clean air are attributes of the right to life, because these are the basic elements which sustain life itself" (Diwan, 1990).

There are series of landmark cases recognizing the right to life. The first case which indicated that right to life includes the right to have a wholesome environment is the *Dehradun Quarrying Case* of 1988, where the Supreme Court in an application under Article 32 ordered the closure of some of these quarries on the ground that their operations were upsetting ecological balance. This wider interpretation of Article 21 by the Supreme Court articulating that right to life includes right to a wholesome environment and thereafter it has been widely applied by the High Courts of Rajasthan, Kerala and Himachal Pradesh (Chatterjee, 2007).

In addition to these specific provisions of the Constitution regarding environment and forest protection, Section 133 of the Criminal Procedure Code has also been invoked in a number of cases from time to time to abate nuisance resulting from pollution and also against statutory bodies like municipalities, corporations and other governmental bodies. To prevent and control public nuisance causing air, water and noise pollution, remedies are available in Part B (sections 133 to 143) and Part C (section 144) of Chapter X of Criminal Procedure Code, 1973. The Common Law remedies pertaining to environmental pollution are also available under Article 372 of the Constitution.

5.1.2.2 Environment and Forest Legislations in India

The legislations relating to environmental protection enacted by the Parliament in the early years of the independence were the Factories Act, 1948, the

Mines Act, 1952, the Prevention of Food Adulteration Act, 1954, the River Boards Act, 1956, the Mines and Minerals (Regulation and Development) Act, 1957, the Ancient Monuments and Archeological Sites and Remains Act, 1958, the Atomic Energy Act, 1962 and the Insecticides Act, 1968. However, these legislations were local in nature and had limited scope. Chatterjee (2007) has pointed out that "early environmental laws in India were scattered in various legislations which may be called environment related legal provisions rather than environmental laws".

Serious legislative attempts for protection of environment and forests in India were started in 1970s. The year 1972 marked a watershed in the history of environmental management in India. India's leading role in United Nations Conference on Human Environment, held in Stockholm in 1972, led to country's commitment to protect environment by changing its attitude from environmental indifference to environmental protection. India was represented in the Conference by the late Prime Minister, Mrs. Indira Gandhi, who initiated several measures and enacted various laws for environment and forests protection in India. Some landmark legislations regarding environmental protection in India are the Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act 1986, and the National Environment Tribunal Act 1995. However, laws concerning forests and wildlife are contained mainly in the Wildlife (Protection) Act 1972, the Forest (Conservation) Act 1980, the Biological Diversity Act 2002 and the Forest Rights Act 2006.

Legislations on Environment

The Water (Prevention and Control of Pollution) Act, 1974

The first important environmental law enacted by the Parliament is the Water (Prevention and Control of Pollution) Act, 1974. As water is a State subject and as

twelve States had passed the enabling resolutions, the Parliament, in pursuance of clause 19 of Article 252, passed this legislation. It defines water pollution as 'such contamination of water or such alteration of the physical, chemical or biological properties of water of such discharge of any sewage or trade effluent or any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or it is likely to create a nuisance or rend such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or of aquatic organisms'. No person shall 'knowingly' cause water pollution; any violation of law will result in penal consequences (Sankar, 1998).

For implementation of these provisions, the Act sets up Central and State Water Pollution Control Boards. Both these boards will be bound by the directions issued by the Central Government and State governments respectively. The central board advices the central government, coordinates the activities of State Boards, provides them with technical assistance, organizes training of the personnel for pollution control. The most important power of the State Boards is to make, vary or revoke an order for the prevention or control of pollution. In exercise of this power, State Board can require any person concerned to construct new or modify existing systems for disposal. No person can set up an industry which is likely to discharge sewage or trade effluents, without the consent of the State Board. If a person who has been given consent does not carry out the work prescribed as part of the conditions of the consent, the board can on its own execute the work and recover the expenses from the person concerned (Sunitha, 2008).

Besides, in order to meet the expenses of the Central and State Water Pollution Control Boards, the Water Cess (Prevention and Control of Pollution) Act was

enacted in 1977. The Act creates economic incentives for pollution control and requires local authorities and certain designated industries to pay a cess (tax) for water consumption. These revenues are used to implement the Water Act.

The Air (Prevention and Control of Pollution) Act, 1981

Air (prevention and control of pollution) Act, hereinafter referred as Air Act was passed by the Union Government under Article 253 of the Indian Constitution. The framework of the Air Act is similar to the one created by its predecessor, the Water Act of 1974. To enable an integrated approach to environmental problems, the Air Act expanded the authority of the central and State Boards established under the Water Act, to include air pollution control.

The Act defines air pollution as 'any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment'. State Government is authorized to notify 'air pollution control areas' to prohibit use of such fuels in the said areas which in the opinion of the State Government is likely to cause pollution. In such areas no person shall establish or operate industrial unit without permission and no person operating industrial unit shall discharge or cause emission of any air pollutant in excess of the prescribed standard. Failure to comply with the provisions of the Act will attract penal consequences.

The Environment (Protection) Act 1986

In the wake of Bhopal gas tragedy in 1984, the Government of India enacted the Environment (Protection) Act (EPA) of 1986 under Article 253 of the Constitution. The purpose of the Act is to implement the decisions of the United Nations Conference on the Human Environment of 1972, in so far as they relate to the

protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property. The Act is an "umbrella" legislation designed to provide a framework for Central Government for the coordination of activities of various central and state authorities established under previous laws, such as the Water Act and Air Act.

According to the Act, *environment* includes 'water, air and land and the interrelationship which exists among and between water, air and land and human beings and other living creatures, plants, micro-organisms and property' [Section 2(b)]. Section 2(c) of the Act defines *environment pollutant* as 'any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to environment'. It also defines *hazardous substance* as 'any substance or preparation which, by reasons of its chemical or physiochemical properties or handling, is liable to cause harm to human beings, other living creatures, plants, micro-organism, property or the environment' [Section 2(e)].

Subject to the provisions of the Act, Central Government shall have the power to take measures necessary for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution [Section 3(1)]. It can constitute authorities, appoint officers and issue directions for the purpose of the Act.

Notifications issued under the Act

The Central Government also issues notification under the EPA for protection to ecologically sensitive areas and guidelines for various matters under the EPA. Some relevant notifications are discussed below:

1. *Doon Valley Notification (1989)* - This prohibits the setting up of an industry in which the daily consumption of coal/fuel is more than 24 MT (million tonnes) per day in the Doon Valley.
2. *Revdanda Creek Notification (1989)* – Under this, the Central Government prohibits setting up of all industries in the belt around the Revdanda Creek as per the rules laid down in the notification.
3. *The Coastal Regulation Zone Notification (CRZ), (1991)* - This regulates activities along the coastal stretches. As per this notification, dumping ash or any other waste in the CRZ is prohibited.
4. *Dhanu Taluka Notification (1991)* - Under this notification, Dhanu Taluka in districh Thane in Maharashtra has been declared an ecologically fragile region and setting up of power plants in its vicinity is prohibited.
5. *The Environment Impact Assessment (EIA) of Development Projects Notification (1994 and as amended in 1997)*- Until January 1994, obtaining environmental clearance from MOEF was only an administrative requirement intended for mega projects undertaken by the government or public sector undertakings. The EIA notification of May 1994 makes EIA statutory for 29 activities (Schedule I of the notification). Thermal power plants and hydroelectric projects fall into this category. The salient features of the notification are as follows:

- All projects listed under Schedule I require environmental clearance from the MoEF.
- Projects under the licensed category of the New Industrial Policy also require clearance from the MoEF.
- All developmental projects whether or not under the Schedule I, if located in fragile regions must obtain MoEF clearance.

- Industrial projects with investments above Rs 500 million must obtain MoEF clearance and are further required to obtain a LOI (Letter of Intent) from the Ministry of Industry, and an NOC (No Objection Certificate) from the SPCB and the State Forest Department if the location involves forestland. Once the NOC is obtained, the LOI is converted into an industry license by the State Authority.
- The notification also stipulated procedural requirements for the establishment and operation of new power plants. As per this notification, two-stage clearance for site-specific projects such as pit-head thermal power plants and valley projects is required. Site clearance is given in the first stage and final environmental clearance in the second. A public hearing has been made mandatory for projects covered by this notification. This is an important step in providing transparency and a greater role to local communities.

6. *Ash Content Notification (1997)* – It requires the use of beneficiated coal with ash content not exceeding 34% with effect from June 2001. This applies to all thermal plants located beyond one thousand kilometers from the pit-head and any thermal plant located in an urban area or, sensitive area irrespective of the distance from the pit-head except any pit-head power plant.
7. *Taj Trapezium Notification (1998)*- This provided that no power plant could be set up within the geographical limit of the Taj Trapezium assigned by the Taj Trapezium Zone Pollution (Prevention and Control) Authority.
8. *Disposal of Fly Ash Notification (1999)* - The main objective of this notification is to conserve topsoil, protect the environment and prevent the dumping and disposal of fly ash discharged from lignite-based power plants. The salient feature of this notification is that no person within a radius of 50 km from a coal or lignite based

power plant shall manufacture clay bricks or tiles without mixing at least 25% of ash with soil on a weight-to-weight basis.

Besides these, Rules for the Manufacture, Import, Export and Storage of Hazardous Chemicals, Bio-medical waste (Management and Handling) Rules, Hazardous Wastes (Management and Handling) Rules, Chemical Accident (Emergency Planning, Preparedness and Response) Rules were also introduced under the Act with the view to protect the environment, nature and health in connection with gene technology and micro-organisms. In 1991, the government further launched a scheme of labeling of environment friendly products with 'ECOMARK'. Under this scheme, any product which is made, used or disposed of in a way that significantly reduces the harm it would otherwise cause to the environment would be considered as environment friendly product.

The Act empowers the Central Government to establish standards for the quality of the environment in its various aspects, including maximum allowable concentration of various environmental pollutants (including noise) for different areas. The standards could be based on ambient levels of pollutants sufficiently low to protect the public health and welfare. The Environment (Protection) Rules of 1986 do allow the State or Central authorities to establish more stringent emission or discharge standards, based on the quality of the recipient system.

The National Environment Tribunal Act, 1995

The decisions taken at the United Nations Conference on Environment and Development held at Rio De Janerio in June 1992, in which India participated, called upon the States to develop national laws regarding liability and compensation for the victim of pollution and other environmental damages. It was considered expedient to

implement the decisions of the aforesaid conference so far as they relate to the protection of environment and payment of compensation for damage to persons, property and the environment while handling hazardous substances. It was in this backdrop, the National Environmental Tribunal Act was passed by the Parliament in 1995.

The objective of the Act was to provide for strict liability for damages arising out of any accident while handling any hazardous substance. It was proposed to establish a National Environment Tribunal for effective and expeditious relief and compensation for damages to human health, property and the environment.

Legislations on Forests

The Wild Life (Protection) Act, 1972

In 1972, Parliament enacted the Wild Life Protection Act under Article 252(1) of the Constitution. The Act provides for state wildlife advisory boards, regulations for hunting wild animals and birds, establishment of national parks and sanctuaries, regulations for trade in wild animals and judicially imposed penalties for violating the Act. It imposes a blanket ban on carrying out any industrial process inside any protected area. In case any forest area within the protected area network is to be diverted for any non-wildlife use, a 'no objection' has to be obtained from the Indian Board of Wildlife and State Legislature, before the final consideration by MoEF. Causing harm to any of the endangered species listed in Schedule I of the Act is prohibited throughout India. Hunting other species, like those requiring special protection (Schedule II), big game (Schedule III) and small game (Schedule IV) is regulated through licensing. A few species classified as vermin (Schedule V) may be hunted without restrictions. The Act is administered by wildlife wardens and their

staff. An Amendment to the Act in 1982 allowed for capture and transportation of wild animals for scientific management. Subsequently, Amendment in 1991 recognized the needs of tribal and forest dwellers. The penalty under section 51 of the Act is compulsory imprisonment of one year which could extent to seven years together with including a minimum fine of Rs 5000 for hunting and trading in animal skins, bones, horns and tusks.

The Forest (Conservation) Act, 1980

Alarmed at India's rapid deforestation and the resulting environmental degradation, the Central Government enacted the Forest (Conservation) Act (FCA) in 1980. The Act prohibits State Governments from declaring any reserved forests, or any portion thereof, as non-reserved without the prior approval of the Central Government. It also prohibits the State Governments from allotting any forest land, or any portion thereof, for any non-forest purpose. The term 'non-forest purpose' includes clearing any forest land for cultivation of cash crops, plantation crops, horticulture or medicinal plants and any purpose other than re-afforestation. Breaking up or clearing of forest land for the purpose of reafforestation cannot be allowed and is not considered as a non-forest purpose. However, work related or ancillary, to conservation, development and management of forest and wildlife cannot be considered as non-forest purpose and hence can be allowed. The Act enables the Central Government to appoint an advisory committee to advice on the grant of prior approval and matters connected with the conservation of forests.

As amended in 1988, the Act requires the approval that the State Governments cannot, without prior approval (of the Central Government), assign by way of lease or otherwise any forest land or any portion thereof, to any private person or to any

authority, corporation, agency or any other organization not owned, managed or controlled by the Government [section 2(a) iii]. Another provision in the Amendment [section 21(iv)] lays down that the State Government cannot, except with prior approval of the Central Government, make any order to cut naturally grown trees in forest land for the purpose of using it for reafforestation.

FCA applies to any forest land irrespective of whether or not it has been declared reserved. It covers the extended meaning of a tract of land covered with trees, shrubs, vegetation and undergrowth intermingled with trees and pasture, be it of natural growth or man-made afforestation. Such extended meaning is justified in order to make FAC effective "as well as to preserve forest land from deforestation, to maintain ecology and to prevent environmental degradation". Therefore, the term forests include not only forests in the dictionary meaning but also any area recorded as forest in government records irrespective of the ownership.

Biological Diversity Act, 2002

India was a party to the Convention on Biological Diversity (CBD) adopted during the Earth Summit held at Rio de Janerio in 1992. It was the first comprehensive global agreement which addressed all aspects relating to the conservation of biodiversity. After an extensive and intensive consultation process over a period of eight years, India has enacted the Biological Diversity Act in 2002 to give effect to the provisions of CBD. The salient features of the Act are as follows:

a) To regulate access to the biological resources of the country with the purpose of securing equitable share in benefits arising out of the use of biological resources; and associated knowledge relating to biological resources;

b) The conservation of biodiversity and sustainable use of its components;

c) To respect and protect knowledge of local communities related to the biodiversity;

d) To secure sharing of benefits with local people as conservers of biological resources and holders of knowledge and information relating to the use of biological resources.

e) Conservation and development of areas of importance from the standpoint of biological diversity by declaring them as biological diversity heritage sites;

f) Protection and rehabilitation of threatened species;

g) Involvement of institutions of State Governments in the broad scheme of the implementation of the Biological Diversity Act through constitution of committees.

India is one of the few countries to have enacted such legislation. The Act is to be implemented through a three-tiered institutional structure: National Biodiversity Authority (NBA), State Biodiversity Boards (SBBs) and Biodiversity Management Committees (BMCs) (MoEF, 2009-10).

The Forest Rights Act, 2006

By recognizing the role of forest dwellers or local communities in the management and conservation of natural resources, the Parliament of India enacted the Forest Rights Act (FRA) in 2006. The Act aims to recognize and provide forest rights to Scheduled Tribes (ST) and other forest dwellers residing in forests for long generations. The Act provides that no member of a forest dwelling ST or other traditional forest dwellers shall be evicted or removed from the land under his occupation till the recognition and verification procedure is complete. The Act was originally enacted to address the issues related with the forest rights of tribals and

other forest dwellers. However, it also puts the responsibility to protect, conserve and regenerate wildlife, forests and biodiversity on people who get these rights.

5.1.2.3 An Assessment of existing Environmental Legislations

It is clear from the above description that a plethora of environmental legislations exist in the country. However, the efficacy of these enactments is in doubt on account of some apparent lacunae. For instance, the Water (Prevention and Control of Pollution) Act of 1974 was brought about with the objective of empowering the Central and State Pollution Control Boards to prevent, control and abate water pollution. However, this Act left many grey areas that were difficult to administer (Dwivedi, 1997). First, a reckless act of serious consequences, although done innocently, is not punishable under the Act. Second, the Act does not cover groundwater contamination. Municipalities which are primarily responsible for treating residential wastes remain free from direct liability. Third, it allows the government agencies too much flexibility. For example the Act states that the head of a polluting unit would not be punished 'if he proves that the offence was committed without his knowledge or that he exercised all due diligence to prevent it'. Fourth, the Act does not give the victims the right to go to the courts to punish the erring units; charges can be brought to courts only by the Boards. Fifth, the penalties for non-compliance with the standards or directions are independent of the extent of violations (Sankar, 1998).

Though, the Air Act passed in 1981, does not contain any apparent lacunae, it has been criticized on the ground that it does not empower the pollution control boards to prosecute polluters outside the limits of 'air pollution control areas'. This provision requires a revisit. Besides, the Air Act does not deal with pollution caused

by smoking in public places. It is more injurious to the health of passive smoker. Serious attention is required for prohibition and proper implementation of smoking in public places (Sunitha, 2008).

The Environment (Protection) Act, 1986 was enacted to cover all the gaps left by the Air and the Water Acts. It was said to be a more effective and bold measure to fight the problem of pollution as compared to all the previous laws in this regard. Under the Act, the Central Government has been empowered to take all appropriate measures to prevent and control pollution and to establish an effective machinery to achieve this object. However, the new Act is not free from flaws. There is no provision relating to forests, even though it is known fact that in India about 50 percent of the energy consumed is non-commercial or collected from fields, trees and bushes. Legislation in respect of enhanced penalties and for tightening the enforcement of the provisions has yet to be enacted. It is also not clear whether the new Act supersedes or supplements the two earlier laws on pollution control. Standards established under the EPA are also dealt with Water Act and the Air Act. In case of violation both under the EPA and Water or Air Act, the penal provisions of the Water or the Air Act would apply. The high penalties thus provided in the Act are therefore illusionary for those violations where Water Act and Air Act also apply. Further, there is no clear provision for public participation which is vital for preserving the environment. The relevant issues are left to official bodies (Air and Water Pollution Control Boards) and other regulatory agencies (Bajwa and Bains, 1987). There also exist uncovered gaps in areas of major environmental hazards. There are inadequate linkages in handling matters of industrial and environmental safety. Control mechanisms to guard against invidious build up of hazardous substances, especially new chemicals in the environment, are weak (Chitnis, 1987).

Thus, there is a need of an appropriate amendment to rectify these lacunae in this revolutionary piece of legislation.

In a study, evaluating the existing pollution control laws conducted by the National Law School of India, Bangalore, experts have stated that the principle legislation is repetitious and poorly drafted. The laws are not backed by policy pronouncements and seem more *ad hoc.*

Apart from the loopholes existed in various legislations itself, the level of compliance of these laws is also quite poor. While analyzing the efficacy of laws in Indian corporate sector, DISHA (Direction, Innovations and Strategies for Harnessing Action), a study conducted by a group of researchers at Tata Energy Research Institute has stated that "the environmental performance among Indian corporate is typically *ad hoc* and restricted to compliance aspects, and even these are not fully addressed. Also, "while pollution norms are being tightened, a key lacuna remains weak enforcement, especially in the small and medium sector" (Priyadarshini and Gupta, 2003).

In addition to these, laws related with forests and wildlife also contain some lacunas. The Wild Life (Protection) Act of 1972, as amended in 1991, has thus far been the most important law for protection of wildlife species and habitats. It has been able to slowdown the rapid decline in ecological status of many areas, in particular forested tracts. However, in its protectionist zeal, various other issues have been completely overlooked or inadequately dealt within the Act, which will threaten the effectiveness of the Act itself. A major deficiency of the act is that it recognized only animals and birds and not plants (Gupta, 1998). The Act has also been criticized on the question of local people's access to livelihood. Pathak & Kothari (1998) have

stated that "a blanket prohibition on human activities (except tourism for some strange reason), as in the case of national parks and severe restrictions on resource extraction, as in the case of sanctuaries, has been a recipe for considerable human suffering, conflicts between local people and protected area (PA) authorities, and sharp decline in public support for conservation. As a result, the protection status of these PAs is itself suffering, since wildlife authorities are woefully ill-equipped to handle the multiple focuses of a rapacious industrial-commercial economy, illegal traders, and a hostile local population".

Similarly, although the Forest (Conservation) Act of 1980, considerably helped in preventing degradation of forests, it does not provide for a blanket ban on diversion of forest land for non forest purposes. A look at the definition of 'non-forest purpose' reveals that the law only regulates and not totally prohibits forest destruction. According to Kulkarni (1989), "the provisions of the Act are defective as the restriction on the State Governments declaring any forest lands as non-forest applies only to the reserved forests. It does not apply to village forests or protected forests, whereas the restriction on allotting any forest land for a non-forest purpose applies to all forest land in the reserved, protected and village categories. This made it possible for some State Governments to declare protected forest lands as non-forest and later on to allocate them to industries or other agencies". Besides these, the Act was also criticized as it does not give concern to the rights of local communities. Pathak and Kothari (1998) pointed out that the Act, though primarily aimed at stopping the runaway diversion of forests for non-forest purposes by State Governments, has had the unintended effect of curtailing even small-scale developmental work and use of forests by local communities. Whether for conservation or for commercial importance, the provisions of the Acts were at the

expense of local indigenous species or local needs. Resentment against it has reached serious proportions in some parts of India, including areas where communities have traditionally been protecting forests (Pathak & Kothari, 1998).

5.2 Policy Framework for Environment and Forests in India

5.2.1 National Policies on Forests

In India, the scientific management of forests was started with the advent of British in the mid-eighteenth century. The British administration directed its forest policy towards commercial interests and the development of agriculture, which was a major source of revenue. The policy was to fell the trees indiscriminately for supply to the Navy and to the shipbuilding industry, for the construction of rail wagons and also for earning revenue. These motives were clearly documented in the first formal policy of forests formulated by British India in 1894 (Balooni, 2002).

National Forest Policy 1894

The first National Forest Policy of British India was based on Dr. Voelcker's Report on Improvement of Indian Agriculture and Review of Forest Administration in British India for 1892-93. As per the policy, forests, being state property were broadly classified under four headings namely, Forest for Preservation, Forest for Commercial purposes, Minor Forests and Pasture Lands. Though, the aim of this policy was to manage State forests for public benefit, certain regulation of rights and restriction of privileges for the use of forests by the neighboring populations was provided in this policy. The policy did not accord due recognition to forestry and placed it below the agricultural needs of the country, especially as far as land use was concerned. As para 6 of the policy clearly mentioned:

"... whenever an effective demand for cultural land exists and can only be supplied from forest, the land should ordinarily be relinquished without hesitation".

The policy stipulated that "forests which are the reservoirs of valuable timbers should be managed on commercial lines as a source of revenue to the States" (Joshi, *et al.*, 2011). According to this policy, the sole motivation by which forests were administered under British rule was the promotion of state interests. The general perception remains that the 1894 Forest Policy aimed at State monopoly over the forest resources with revenue earning through timber harvesting the prime motive, and with agriculture given precedence over forestry (Gadgil and Guha, 1992).

National Forest Policy 1952

After independence in 1947, the Government of India made no substantive changes to this administrative structure. The State retained exclusive control over the management and protection of forest resources. The principles which were to guide the forest policy of independent India, were enunciated in the National Forest Policy of 1952. The policy identified vital national needs which included a system of balanced and complementary land use, need of checking of denudation of mountainous regions, erosion of river banks and invasion of sea-sands on coastal tracts and the need of ensuring supply of fodder and small wood, etc. This policy also classified forests in four groups, namely, protected forest, national forest, village forest and tree lands. The policy also dealt upon the proportion of forest areas and for the first time a goal was adopted for bringing 60 percent of the area in hilly tracts and 20 percent of the area in plains (one-third of the country's total geographical area) under forest cover for ecological reasons.

However, even after the enunciation of the National Forest Policy of 1952, matters did not change materially on the ground. The policy reiterated the principles of colonial forestry, as enshrined in the earlier forest policy resolution of 1894 and reinforced the exclusive rights of the state with regard to the management and control of forest resources. It "asserted that the fundamental concepts underlying the colonial policy were sound; they just needed to be reoriented" (Pathak, 1994). The policy aimed to increase Government control over forest resources and develop forests to meet the timber needs of industry and defense. On the point of relinquishment of forest land for agriculture purposes, Para 8 of the policy clearly mentioned- "the notion widely entertained that forestry, as such, has no intrinsic right to land but may be permitted on sufferance on residual land not required for any other purpose, has to be combated".

With regard to the public involvement in forestry, the policy declared that village communities should not be permitted to exercise their traditional rights over the forests at the expense of national interest (MoEF, 2006a). Thus, the Government continued with the British forest policies even after independence.

Recommendations of the National Commission on Agriculture 1976

A major shift in forest sector was arrived in 1976 with the recommendations of National Commission on Agriculture (NCA) on improvement of forests. The NCA was set up in 1970 by the Government of India to examine comprehensively the progress of agriculture including forestry and to make recommendations for its improvement and modernization. The Commission made a number of recommendations on various aspects of 'Forestry' in part IX of its report. These recommendations were based on recognizing the protective and aesthetic functions of

the forests which include regulation of grazing and shifting cultivation, satisfying the domestic needs of the people for various forest products, undertaking large scale industrial plantations, carrying out forestry operations either departmentally or through forest labour cooperative societies, adoption of social forestry and preference to socially backward and unemployed in providing employment through forestry operations. Out of various important recommendations, two major recommendations of the Commission regarding forest policy were:

"Institutional changes should be brought about in the management for production forestry, and man-made forests be raised on an extensive scale with the aid of institutional financing".

"The existing system of harvesting of major and minor forest produce through the intermediary contractor must be replaced by taking it up either directly by the SFDs or by a network of forest labour cooperative societies, or by a combination of both" (MoEF, 2006a).

On the recommendations of NCA, the Government of India launched a 'social forestry' programme in the late 1970s with a view to carrying out tree planting in and around village areas. The programme was designed to reduce the pressure of rural population on government forests by growing fuel wood, fodder and small-timber required by the local communities. However, social forestry failed to achieve its primary objective of easing pressure on government forests. The local communities continued to depend on forests for their needs and the Forest Department was unable to control continuing forest degradation. There was also an increase in the number of conflicts between the communities and the Forest Department. By and large, the State failed to involve people in the social forestry programme (Ballabh, 1996). These

circumstances led to the State to think of changing its non-participatory approach to forest management to a participatory one, increasingly involving local people. Consequently, a new forest policy was issued in 1988 that completely reversed the objectives of forest management in India. The new policy stressed on management of forests for conservation and meeting local communities' needs and made commercial exploitation and revenue generation secondary objectives (Saigal, 2005).

National Forest Policy 1988

National Forest Policy, 1988, the second forest policy after India's independence, was formulated by the Government of India through a resolution dated 7 December 1988. The policy marked a major departure from the past policies and almost reversed the objectives of the forest management in India. Ecological security became the prime objective and the focus of forest management shifted from commercialization to the maintenance of environmental stability and restoration of ecological balance through preservation and conservation of forests. The policy reiterates increasing the forest cover to 33% of the geographical area of the country through large-scale afforestation and social forestry programs, both in recorded forest areas and degraded unproductive land outside forest areas (MoEF, 2009b). The other main objectives of the policy are the conservation of the country's natural heritage and biological diversity, increasing the productivity of degraded forests, and meeting the local needs of the people and encouraging their participation in the protection and management of forests. This was a clear improvement over the Forest Policy in 1952, as for the first time "environmental stability" was considered as the prime object of the Forest Policy and direct economic benefits were subordinated to this principal aim (MoEF, 2006a).

The NFP 1988 departs significantly from previous policies because it advocates a decentralized approach towards natural resources management. The policy mandates that the local people must be actively involved in programmes of protection, conservation and management of forests. For the first time, local people living in and around the forests were given a chance to participate in the management of forests. They were considered partners, not only in protection and regeneration of forests but to share the usufructs and profits as well (Murali *et al.*, 2003). In fact, this Policy is a harbinger of 'management change', i.e. from Government managed to the people managed forests. As a follow up to the NFP 1988, the Government of India has issued orders and guidelines on Joint Forest Management (JFM), an institution initiated by the Government of India in 1990. It was regarded as the implementing mechanism of this policy.

Joint Forest Management

In pursuance of the directions established in National Forest Policy 1988, the Government of India issued a set of broad directions to the State Governments, on 1 June 1990, about the involvement of village communities and village organizations in forest management. Joint Forest Management was thus born in India. In view of failure of social forestry programme and expensive afforestation programmes mooted by forest department, JFM offers an opportunity to conserve forest, reclaim degraded lands and grow biomass to meet the growing demands in a participatory and cost-effective way (Murali *et al.*, 2003). Under JFM, the Forest Department and the village community enter into an agreement to jointly protect and manage forest land adjoining villages and to share responsibilities and benefits. The village community is represented through a body specifically formed for the purpose. There are three kinds of committee like committees for protection of well-stocked forests, committees for

rehabilitating degraded forests, and committees for participatory biodiversity. The main role of the JFM committee is to protect the regenerating forests from being further degraded by activities such as grazing and encroachment (Basu, 2010). The essential difference between social forestry and JFM is that while the former sought to keep people out of forests, the latter seeks to involve them in the management of forest. JFM is one of the thrust areas of the forestry programme. It has been envisaged as an effective tool for halting further degradation of forests. Communities in about 170,000 forest fringe villages are at present involved in the JFM programme. By March 2010, about 112, 896 JFMCs were engaged in JFM programme, and more than 24.6 mha of forest area was covered under plantation programme (MoEF, 2011).

However, the programme has many shortcomings. According to Murali *et al.* (2003) various social, economic and cultural factors have affected the progress of JFM. Some of the problems that have affected the spread and performance of JFM are lack of understanding of the locals' socio-economic and cultural value system, not giving priority to gender issues, inter and intra village conflicts, lack of statutory authority to local institutions, inadequacy of meaningful involvement of the people, coverage of degraded forests only under JFM, donor driven rather than need driven programme, target oriented rather than people oriented and failure to address issues of sustainability. Apart from these, the findings of JFM impact studies by Singh *et al.* (2005) suggest that the current strategy of decentralized forest management is not able to ensure active cooperation of the participating communities.

5.2.2 National Policies on Environment

National policies governing environmental management in India include the Policy Statement on Abatement of Pollution (PSAP) 1992, the National Conservation

Strategy and Policy Statement on Environment and Development (NCS/PSED) 1992 and the National Environment Policy (NEP) 2006.

Policy Statement on Abatement of Pollution 1992

The PSAP, issued by the MoEF in February 1992, is a Government's commitment on abatement of pollution for preventing deterioration of the environment. The chief objective of the policy statement was to integrate environmental considerations into decision-making at all levels.

In order to control pollution, the policy adopted various guiding principles such as the prevention of pollution at source, adoption of best available clean and practicable technologies, the polluter pays principle and public participation in decision making. The policy called for taking into consideration the environmental effects of hazardous and toxic products right from production stage to disposal in regulations. It also called for supplementing regulations for liability and compensation for damage with standards so as to promote greater care and caution in management of hazardous waste and remedial action in case of contamination of soil and ground water (Thakur, 1997).

National Conservation Strategy/ Policy Statement on Environment and Development 1992

The NCS and PSED has been prepared and adopted by the Central Government in June 1992. It provides an overarching policy framework on environmental management, including conservation of natural resources and economic development. Sustainable development is the key phrase in the agenda for action and the Preamble (Thakur, 1997). The main objectives of the policy were:

1. To ensure sustainable and equitable use of resources for meeting the basic needs of the people.
2. To take steps for restoration of ecologically degraded areas.
3. To ensure that development projects are correctly cited with least adverse environmental consequences.
4. To encourage public participation in environmental improvement programmes.
5. To effectively implement various environmental laws and regulations for environmental protection through creation of requisite enforcement machinery, and
6. To promote environmental awareness by creating a network of infrastructures for environmental education.

The Key instruments for achieving these objectives were environmental impact assessments (EIA), educational campaigns and public participation (Thakur, 1997).

National Environment Policy 2006

Building on earlier policies, the National Environment Policy (NEP) of 2006 is the most recent pronouncement of the government's commitment to improve environmental conditions while promoting economic prosperity nationwide. While earlier policies (PSAP & PSED) have recognized the need for sustainable development in their specific contexts and formulated strategies to give effect to such recognition, the NEP 2006 seeks to extend the coverage and fill in gaps that still exist, in the light of present knowledge and accumulated experience (MoEF, 2006b).

The key environmental objectives of the policy include conservation of critical environmental resources, intra-generational equity and livelihood security for poor, integration of environmental concerns in economic and social development, efficiency

in environment resource use, good environmental governance and enhancement of resources for environmental conservation. The policy promotes mainstreaming of environmental concerns into all development activities, advocating important environmental principles and identifying regulatory and substantive reforms. With respect to regulatory reforms, the NEP recommends revisiting the policy and legislative framework to "develop synergies among relevant statutes and regulations, eliminate obsolescence, and amalgamate provisions with similar objectives." The NEP identifies a new framework for legal action that includes application of a merger of both civil and criminal sanctions, adoption of innovative economic instruments, and public-private partnerships in strengthening environmental compliance and enforcement. As the nodal agency, the Ministry of Environment and Forests (MoEF) is responsible for implementing the PSAP, NCS/PSED and NEP (OECD, 2006).

Conclusion

On account of the above discussion it can be concluded that international declarations such as Stockholm and Rio de Janerio paved the way for the evolution of an extensive network of environment and forests legislations in India. A number of legislative and regulatory measures were taken by the Government of India for the control of pollution as well as for the protection and conservation of forests and wildlife in the country. While the Water and Air (Prevention and Control of Pollution) Acts of 1974 and 1981 are the major pollution control laws, the Environment (Protection) Act (EPA) of 1986 is the umbrella legislation dealing with the protection of environment in India. Besides, laws concerning forests and wildlife protection are contained mainly in the Wildlife (Protection) Act 1972, the Forest (Conservation) Act 1980, the Biological Diversity Act of 2002 and the Forest Rights Act, 2006. However, the efficacy of these enactments is in doubt on account of weak enforcement.

In India, the CPCB and the SPCBs are responsible for implementing legislations relating to prevention and control of pollution. However, insufficient coordination between these institutions, lack of standard compliance and enforcement policies, and significant human and technical capacity constraints, deter effective functioning of the system, causes poor enforcement of various pollution control laws (CAEP-TERI, 2011). As a result, the quality of natural resources like water and air continues to deteriorate.

Apart from these, laws related with forests and wildlife have also been criticized on account of some apparent lacunas. For instance, the Forest (Conservation) Act, which was enacted in 1980 to regulate the large scale diversion of forest land for non-forest purposes, does not provide a blanket ban on such diversion. As a result, large tracts of forests are still being diverted for agriculture, mining as well as for other development purposes, causing destruction of forests. Besides, the laws were also blamed for curtailing the rights of local communities. As Pathak and Kothari (1998) pointed out that the current legislations on forests and wildlife do not adequately cover the aspects of access and benefit sharing that could be crucial in creating a stake for conservation amongst local people. Thus, it is clear that the laws are continuous of the colonial model in which the state and those close to it are benefited from resource use and conservation, while communities closest to resources have to pay the cost of reduced access. Building equitable access and benefit sharing into the law will therefore require a reorientation of the existing laws and perhaps some new legislation.

Thus, there is a need to remove existing lacunae and leeway in the legislative measures. Apart from this, there must be strict enforcement of various legal provisions as the laws, however voluminous but confined to statute books, have no

value in the absence of proper and active implementation. All the existing legislations need to be looked into very thoroughly and necessary provisions need to be made in the Acts about stringent regulatory mechanisms. Similarly, mere provisions of various policies governing environment and forest management, cannot achieve the desired results unless these are properly implemented. A mechanism needs to be put in place at the MoEF and State levels to monitor implementation of various policy provisions and suggest rectifications.

Chapter - 6

People's Initiatives for Environment and Forest Management in India

PEOPLE'S INITIATIVES FOR ENVIRONMENT AND FOREST MANAGEMENT IN INDIA

During the past several decades, there has been an increasing concern over environmental problems throughout the world involving depletion of ozone layer, acid rain, green house effect, soil erosion, deforestation, water pollution, air pollution, etc. The severity of these problems is in large part related to each nation's quest for development, technological advancement, industrialization and urbanization which causes unprecedented demands on the regenerative capacity of ecosystems and jeopardizes conservation of the environment. In addition, the introduction of resource and energy intensive production technologies under such conditions leads to economic growth for a small group of population while undermining the material base for the survival of the large majority. It should be noted that in respect of resource utilization the recent period in human history is in sharp contrast with all the earlier periods. Ever expanding and intensifying industrial and agricultural production generated additional demands, which caused depletion of resources and denied the citizens their fundamental right over natural resources. This resource intensive classical model of development has resulted in environmental conflicts across the world. Its ramifications can be noticed in the increasing environmental movements and concern all over the world in general and India in particular.

As in other parts of the world, a number of environmental movements have emerged in India demanding restoration of balance between development and environment and asking for a greater role for the state agencies in the protection of the environment. An important feature of these movements is that they brought communities to the centre stage of Indian environmental discourse. The environmentalist stated that local communities are best suited to conserve natural

resources as their survival depends in the sustainable use of such resources. They argued that in order to make the sustainable use of resources, traditional rights should be given back to the people which were taken away by the State. Although the beginning of environmental movements or people's initiatives for environmental protection in India can be traced back to the early twentieth century when people protested against the commercialization of forest resources during the British colonial period, it was only in the 1970s that it received huge public attention.

6.1 Evolution of Environmental Movements in India

A characteristic of Indian civilization has been its sensitivity to the natural ecosystems. Vital renewable natural resources like vegetation, soil, water, etc, were managed and utilized according to well defined social norms that respected the known ecological process. The indigenous modes of natural resource utilization were sensitive to the limits to which these resources could be used. In the pre-colonial indigenous economic processes, the levels of utilization of natural resources were generally not significant enough to result in drastic environmental problems. There were useful social norms for environmentally safe resource utilization and people protested against destructive resource uses even against kings (Bandyopadhyay and Shiva, 1988).

A major change in the utilization of natural resources of India was introduced by the British, who linked the resources of this country with the direct and large scale demands of Western Europe. Natural resource utilization by the East India Company, and later by the colonial rulers, replaced the indigenous organizations for the utilization of natural resources, like water, forests and minerals that were mainly managed as and controlled by local communities. With the establishment of British

colonial rule in India, the ever-increasing resource demands of the industrial revolution in England were largely met with materials from colonies like India. Forced cultivation of Indigo in Bengal and Bihar, growth of cotton in Gujarat and the Deccan led to large-scale commitment of land for the supply of raw materials for the British textiles industry. Forests in the sensitive mountain ecosystems like the Western Ghats or the Himalayas were felled to build battle-ships or to meet the requirements of the expanding railway network. Forests of Bengal, Bihar and Orissa were used for running fuel-wood locomotives in the earliest periods of railway expansion. Besides, the latter stages of colonial resource utilization and control included the monopolization of water rights like in the Sambhar Lake of Rajasthan or the Damodar Canal in Bengal. The colonial intervention in the natural resource management in India led to conflicts over vital renewable natural resources like water and forests between colonial rulers and indigenous people and induced new forms of poverty and deprivation. Changes in resource endowments and entitlements introduced by the British came in conflict with the local people's age old rights and practices related to natural resource utilization. As a result local responses got generated through which people tried to regain and retain control over local natural resources (Bandyopadhyay and Shiva, 1988). Many struggles were organized to protest against the colonial forest policy during the early decades of the 20th century. The Indigo movement in eastern India, Deccan movement for land rights or forest movements in many forest areas of the Western Ghats, Central Indian Hills or the Himalayas, were the obvious expressions of protest generated by these newly created conflicts (Bahuguna, 1990).

Even with the political independence of the country, the control over natural resources vested with the Indian state and the colonial institutional framework for

natural resource management was continued. The post-independent state failed to build up a development agenda based on the needs of the people and continued to advocate the modern capitalist agenda which led to the destruction of environment, poverty and marginalization of local communities. Consequently, the process of resource intensive development was accelerated. Economic development implied more intensive resource utilization which in the prevailing technological and institutional framework, led inevitably to widespread environmental degradation (Omvedt, 1984). As the scale of economic development escalated from one Five-Year Plan to another, the disruption of the ecological processes that maintain the productivity of natural resource base started becoming more and more apparent. Forests that are today considered as one of the major components of environmental security were mercilessly exploited for generating revenue. The Government began felling trees for revenue and the Forest Department, which continued the colonial forest policy, converted the primitive tropical forests into monoculture teak and eucalyptus plantations. Also, the other development projects like dams and mines exerted largely negative influence on the forests. This resource intensive development process led to the narrowing down of the natural resource base for survival of the economically poor and powerless, either by direct transfer of resources away from basic needs or by destruction of the essential ecological process that ensure renewability of the life supporting natural resources. In the background of this, the environmental movements came up as people's response to this new threat to their survival and as a demand for the ecological conservation of the vital life support systems. In fact, they have emerged as a consequence of negative externalities imposed by the destructive pattern of development (Gadgil and Guha, 1994).

6.2 Environmental Movements in India

India has witnessed a wide range of environmental protection movements varying on the basis of issues. These include forest and land based movements resulted from large scale commercial use of forest materials as well as unequal access to land resources. The Chipko movement in the Himalayas and the Appiko movement in the Western Ghats are the main examples of these movements. Other forest-based movements include the agitation against the replacement of *sal* trees by teak species in the Jharkhand-Bastar belt in the country. The land-based struggles consist largely of localized agitations against land degradation due to the indiscriminate use of organic chemicals, mining, and constructions (in urban areas). These movements are not documented enough to enable a detailed analysis. The Manu Rakshana Koota (Save the Soil) movement in Karnataka is a specific case of land-based movement launched against the Wasteland Development Policy that empowers the state to convert common village land into wasteland for social forestry purposes particularly for eucalyptus plantations. Similar protest groups existed in Gujarat in the early 1980s, which extensively debated the state social forestry programme (Andharia and Sengupta, 1998).

Next to the forest-based movements, environmental activism around development projects is another example of a broad-based environmental struggle with larger coverage and impact. The specific development projects against which sustained movements have been launched by the environmentalists include dams, power projects, industrial plants, railway projects and mining. The dam-related agitations of local groups cover the entire geographical area of the country. The large-scale submergence of forests and agricultural lands, that is the pre-requisite for the big river valley projects, always takes a heavy toll of dense forests and the best food

growing lands. These have been usually the material basis for the survival of large number of people in India, especially tribal people (Bandyopadhyay and Shiva, 1988). Among various dam-related movements, most notable were Silent Valley Movement in Kerala, Narmada Bachao Andolan in Gujarat and Madhya Pradesh and Movement against Tehri Dam by Tehri Bandh Virodhi Samiti. The other such type movements include protests against Pong dam in the north and the issues range from rehabilitation of the project affected persons, land compensation and the negative impact of the project on the environment and local communities.

Exploitation of mineral resources, in particular, the opencast mining in the sensitive watersheds of Himalaya, Western Ghats and Central India have also done a great deal of environmental damage. As a result environmental movements have come up in these regions to oppose the reckless operations of mining. Most successful among them is the movement against limestone quarrying in Doon Valley. Here the volunteers of Chipko movement have led thousands of villagers in a peaceful resistance to oppose the reckless functioning of limestone quarries that is seen by the people as a direct threat to their economic and physical survival (Shiva, 1991). Beyond the Himalaya, the ecology movement in the Gandhamardan hills in Orissa against ecological havoc of bauxite mining has gained momentum and it draws inspiration from the Chipko movement. The mining project of Bharat Aluminium Company (BALCO) in the Gandhamardan hills was being opposed by local youth organisations and tribal people whose survival was directly under threat. The peaceful demonstrators had claimed that the project could only be continued 'over our dead bodies' (Rai, 1986). The situation is more or less the same in large parts of Orissa-Madhya Pradesh region where rich mineral and coal deposits were being opened up for exploitation and thousands of people in these interior areas were being pushed to

deprivation and destitution. This includes the coal mining areas around the energy capital of the country in Singrauli. In these interior areas of central India, movements against both mining and forestry were becoming extremely volatile and people's resistance was growing.

Besides these, the civil society organization, NGOs, concerned individuals, especially lawyers, scientists, environmentalists and social activists have also collectively protested against growing environmental pollution due to industrialization. The main issues, raised in these protests were the stricter pollution control measures in industries and the prevention of reckless exploitation of industries without considering design, location and livelihood issues of local population. They sought the intervention of the judiciary and drew the attention of the state for showing concern to the pollution caused by the process of modernization. These anti-industrial pollution movements have largely been concentrated in urban areas. Examples of such movements include Zahirili Gas Morcha in Bhopal against Bhopal Gas Tragedy, Ganga Mukti Andolan in Bihar, Movement against Harihar Polyfibre factory in Karnataka, and Movement against poisoning of Cheliyar river in Kerala by Kerala Shastra Sahitya Parishad (KSSP) (Andharia and Sengupta, 1998).

However, the movements which have significant impact on environmental protection in India are the Silent Valley Movement in Kerela, Chipko Movement in Uttar Pradesh, Appiko Movement in Karnataka, Narmada Bachano Andolan in Central India and the Movement against Limestone Quarrying in Doon Valley. They aim at halting environmental degradation or bringing about environmental restoration or regeneration or sustainable use of natural resources. A few of them were able to get the support of outsiders like NGOs, social activists, national media and sometimes international networks to expose the impact of environmental pollution and

degradation. They can be referred as macro level environmental movements, used to influence government and institutional policies in favor of environmental protection (Reddy, 1998). A close look at the evolution of these movements suggests; i) there is a link between the livelihoods of the people and their participation in the movements ii) the participation of local people plays a major role in the protection of environment (Guha, 1991; Wagle, 1997; Reddy, 1998). This may be due to the fact that ecological aspects are linked with the problems associated with the people whose survival is attached to the status of natural resources (Sahu, 2007).

6.2.1 Chipko Movement

The origin of the Indian Environmental movement can be ascribed to the Chipko movement. As the Chipko movement focused world attention on environmental problems, it is popularly regarded as the most influential environmental movement in India. The movement got its name (Chipko) from the fact that when some men came to cut the trees with axes, the people of relative forests clung to the trees and told them, " we will not let you cut the trees; first cut us down, then you can cut the trees". These people were ready to risk injury and probably death rather than see the trees in their villages cut down.

The origin of Chipko movement can be traced back to the 18th Century. In 1730, hundreds of women and men from Bishnoi Jain Sect in Rajasthan laid down their lives to save the sacred Khejri trees, which the authorities wanted for burning lime. This had resulted in a royal ban on cutting of green trees and hunting of animals within the revenue boundaries of Bishnoi villages. Although, Bishnois paid a huge price for saving a few trees, this incident inspired many others to fight and protect trees and wildlife (Raut, 2004). Consequently, the movement was again started in

1970s, when the hill people in the 'northern region' of the state of Uttar Pradesh (now Uttarakhand) were gathered to save the Himalayan forest resources from exploitation by contractors from outside. The Himalayan region has always been exploited for its natural wealth, be it minerals or timber. In 1960, from the point of view of border security, a vast network of roads was constructed in the mid-Himalayas besides taking up projects of various types. All this was disastrous for the forests. Trees became the target for commercial exploitation. Soon, the forest cover started deteriorating at an alarming rate, resulting in hardships for those involved in labor-intensive fodder and firewood collection. Felling of trees also resulted in deterioration in the soil conditions and soil erosion in the area. All this resulted in a series of disastrous floods in the region in July, 1970, which caused havoc in the region (Mawdsley, 1998).

Gradually, a rising awareness of the ecological crisis, which came from an immediate loss of livelihood caused by it, resulted in the growth of political activism in the region. It was here the *Dasholi Gram Swarajya Mandal* (DGSM) (Dasholi Society for Village Self-Rule), Gopeshwar, which was engaged in social work in Uttarakhand, stepped in. During the relief operation undertaken by the volunteers of DGSM, it was found that the watersheds that were commercially deforested to the tune of around 16,082 acres were the source area for the above flood. Towards this, DGSM organized a collective protest with the local people against commercial forest felling in the sensitive catchments of the Upper Alaknanda River, a major tributary of the Ganga. It was decided to put up a non-violent protest of hugging the trees (Chipko) that were marked for felling. This concept though looked rudimentary at that time, gradually found widespread acceptance. The very first direct action was launched in the vicinity of Gopeshwar, the head quarter of DGSM in the year 1973. In early 1973 the forest department refused to allot ash trees to DGSM for making

agricultural implements. On the other hand, the forest department allotted ash trees to a private company. This incident provoked the DGSM to fight against this injustice through lying down in front of timber trucks and burning resin and timber depots as was done in Quit India movement. When these methods were found unsatisfactory, Chandi Prasad Bhat - one of the leaders, suggested of embracing the trees and thus 'Chipko' was born (Bahuguna, 1990 and Guha, 1991). This form of protest was instrumental in driving away the private company from felling the ash trees. Subsequently, over the next five years, the movement spread to other neighboring areas, and within a decade throughout the Uttarakhand Himalayas.

The Chipko movement in its broader context was concerned with the conservation of the ecological balance in nature. As such issues are not very simple and cannot be settled by mere laws and rules, there was a need to educate the masses and make them aware about the value of nature. Bearing this in mind, the DGSM began organizing conservation camps, known as eco camps in areas affected by landslips in the mid-Himalayas. At these camps, environmental knowledge was imparted and afforestation was done by the people of the region. The local people planted trees on barren and unutilized land around villages. It was entirely a people's strategy with their real participation and involvement. People became so involved that they did not mind even braving forest fires to save the trees. Besides plantation programs, issues pertaining to various developmental aspects were also discussed. The villagers demanded that no forest-exploiting contracts should be given to outsiders and local communities should have effective control over natural resources like land, water, and forests. They wanted the government to provide low-cost materials to small industries and ensure development of the region without disturbing the ecological balance. Thus, the movement, which began with saving the forest from

commercial exploitation, became an instrument to fight against social injustice, improper developmental planning, and faulty environmental policies. It became a symbol of strong international movement committed to the preservation of nature, combating pollution and preserving wildlife. Villagers who were mere spectators of government policies became a voice to reckon with. They could question the developmental planning, if found is not tune to the environmental condition of the terrain (Sahu, 2007).

The movement has been successful in forcing a fifteen-year ban on commercial green felling in the hills of Uttar Pradesh, in stopping clear felling in the Western Ghats and the Vindhyas, and in generating pressure for a national forest policy which is more sensitive to the people's needs and to the ecological development of the country. In many watersheds, the denuded forest cover had been reclaimed, biomass production had gone up and lost prosperity was gradually being reclaimed. The movement also took the lead in introducing smokeless *chulhas* and gobar gas plants in the area. The DGSM had also successfully attracted the attention of planners on the impact of big dams and hydel projects in the mid-Himalayas (Oza, 1991).

Viewing these developments, the movement of eco-development camps had increased and spread over many parts of the region witnessing overwhelming participation of the local people especially the women. With time, these camps became so popular that, besides the local people, scientists, journalists and policy planners began to participate in order to understand the approach. Even the journalists like Anupam Mishra from Gandhi Peace Foundation and Late Anil Agrawal from Center for Science and environment reported the activities of these camps in various forums. In addition to this, scientists tried to assess the impact of the eco-development

camps through their independent studies. Prof Madhav Gadgil from Indian Institute of Science, Bangalore remarked, "The camps organized by Dasholi Gram Swarajya Mandal (DGSM) demonstrate the ideal of eco-development. The unique feature is that the close association of DGSM workers with the villagers for eco-development is based on a long term and thoughtful commitment. DGSM also has the ability to draw upon the expertise and assistance of the administrative machinery. These camps are an integral part of sustainable eco-development in the Upper Alaknanda basin. The environmental conservation work taking place in the area through these camps is a unique type of approach anywhere in India". Similarly, Prof. Hanumanta Rao, the then member of Planning Commission made the following remarks. "DGSM has provided a methodology for people's participation. Its leadership is full of enthusiasm. They are the initiators, promoters, educators and implementers of eco-development projects. Fully immersed in it, they are able to generate enthusiasm and self-confidence among the people. A high level of awakening is prevailing in Chamoli district (DGSM headquarter) among the local people and the eco-restoration drive is going on in the form of a movement". Prof. Rao further stated that the district administration should take benefit of this awakening in their developmental work. Thus, the Chipko movement has successfully involved people in greater issues of ecology and environment.

6.2.2 Appiko Movement

As mentioned earlier, the Chipko movement which was initiated in 1973 in a part of the Himalayan region, had been successfully launched throughout the Uttarakhand Himalayas within a decade. During 1980s, the movement had spread to several other parts of the country. In Western Ghats, in the Uttar Kannada region of Karnataka, the Chipko inspired villagers to start an identical movement and named it

"Appiko", meaning the same as *"Chipko"* (to hug or to cling). Here, the destruction of the forest was caused by commercial interest for obtaining timber. Natural forests were cleared by the contractors, which led to severe soil erosion and drying up of perennial water resources. In the Saklani village in Sirsi, the people were deprived of the only patch of forest left near their villages to obtain fuel wood, fodder and honey, etc. They were denied of their customary rights to these products. In September 1983, this led youth and women to launch Appiko movement in South India. Youth and children from Saklani and surrounding villages walked five miles to a nearby forest and hugged trees there. They stopped the axe-men who were felling trees pursuing the order of the forest department of the state. The people demanded ban on felling trees. They were ready to sacrifice their lives for this cause. The protests continued for 38 days, which forced the government to finally withdraw the felling orders. This, simple, non-violent action became popular statewide and the people joined this movement spontaneously in many forest areas of the Western Ghats.

Appiko activists marched along the Western Ghats from Coorg to Goa spreading the movement's message. *Padyatras*, slide shows and street plays created mass awareness. In Coorg, people stopped the felling of trees in the Cauvery catchment area, for which the Government had given felling permits to plywood units. The people camped in the forests for months to save the natural wealth. In Dakshina Kannada, the authorities of the Subramanya temple resorted to the Appiko movement to save the evergreen forests while Shimoga youth groups stopped felling by forest-based units. This vigorous launching of the movement forced the Government to change some aspects of its forest policy, felling of natural forests in the Western Ghats was stopped; abandoned; allotment of timber to units was stopped and the

Government itself stopped falling green trees for revenue. Falling had thus been greatly reduced helping forests to rejuvenate themselves (Oza, 1991).

The Appiko movement had three main objectives, popularly known in Kannada as *'ulisu'* (to conserve); *'belesu'* (to grow) and *'balasu'* (rational use). The first priority was to conserve the meager, remaining tropical forests of the Western Ghats, which were constantly under threat. This was essential to protect the catchment areas of rivers for sustained yield of water in South India. The second objective was to bring back greenery to areas where deforestation had destroyed the vegetation, first by natural regeneration and then by involving people in enclosing the target areas and taking measures against fires. Also the locals were encouraged to start nurseries to grow saplings of indigenous species. And the third objective was to make people use forest resources rationally. To reduce the pressure from forests, people were encouraging to install biogas plants and to build fuel efficient *chulas*. This had influenced many farmers and the consumption of forest products to meet energy needs was reduced considerably (Karan, 1994).

The movement succeeded in its three fold objectives, (i) protecting the existing forest cover, (ii) regeneration of trees in denuded land, and (iii) utilizing forest wealth with proper consideration to conservation of natural resources. Besides, the movement created awareness among the villages throughout the Western Ghats about the ecological danger posed by the commercial and industrial interests to their forests-the main source of their sustenance.

In fact, the movement has been successful because of the constant interaction with villagers, by encouraging their participation in all programmes. Through people's participation, Appiko evolved a sustainable development strategy that

conserves and improves natural resources such as forests. The movement also interacted with action groups in other regions of the Western Ghats. In Kerala, its activists were in touch with local groups to evolve a strategy to save the forests. In addition to this, Appiko was working with the Save Eastern Ghat Organization, while in Goa, it was helping environmental groups. Thus, it is clear that Appiko movement has created a mass awakening about conservation in South India and particularly in Karnataka, emphasizing the need to involve the local people in saving the natural wealth in Western Ghats (Omvedt, 1984).

6.2.3 Silent Valley Movement

The Silent Valley, one of the few remaining undisturbed rain-forest areas in India, lies in the Malabar region, the least-developed section of the state of Kerala, at the southern end of the Western Ghats. Remote from main urban centers or highways, the valley has experienced relatively little timber cutting and almost none of the peasant or tribal farming that characterizes the rest of rural southern India. Many rare species of plants, ferns, and endangered fauna survive in the valley. However, during the early 1960s the state government began planning a dam on the Kuntipuzha River, which flows through the valley, to generate hydroelectricity as the basis for regional economic development.

It was here the *Kerala Shastra Sahitya Parishad* (KSSP), a network of rural school teachers and local citizens that promotes environmental scientific projects in the villages, which stepped in. While analyzing the project, the KSSP concluded that the Silent Valley project would make only a marginal contribution to regional development. Thus the group opposed the project with a campaign that brought into sharp focus the ecological consequences, specifically the possibility of extinction of

species that had evolved over millions of years, and thus the Silent Valley Movement was born. Villagers in Kerala also learned that new industries and clear cutting of timber in the upper watersheds of the river were contributing to the disruption of streams and water supplies. The movement began to challenge the idea that energy generated by the dam would benefit the rural people of Kerala. Most of the energy from the project was to be exported to industrialized areas of Kerala and surrounding states. The movement asserted that the local environment would be disrupted with benefits going to Trivandrum, the state capital. The state government favored the project, but other environmental groups expressed doubts. After years of activism the movement persuaded the Indian government to appoint a high-level committee to examine the project's environmental and socioeconomic effects. The committee subsequently recommended abandonment of the scheme (Kothari, 1986), which the state government accepted in 1983.

An important feature of the movement is that unlike the other anti-dam movements where displacement and rehabilitation of the affected people have been the major issues, the Silent Valley movement raised the fundamental issue of ecological balance. According to Sethi (1993) "the Silent Valley movement was unique because building a dam in this uninhabited area would not involve displacement of people, and thus was fought primarily on environmental grounds". The movement was launched to save the large tracts of Indian tropical rain forests (Andharia and Sengupta, 1998). Thus, the controversy over the Silent Valley project marked severe environmental dispute in India and established a model wherever a major development project, specifically a dam, threatened ecological balance. For example, Save the Narmada Movement cited the decision about the Silent Valley in mobilizing support for its stance against dam projects (Karan, 1994).

6.2.4 Narmada Bachao Andolan (NBA)

The most popular movement in the environmental history of India is the movement against the Narmada River Valley Project. According to Kumar (2006), the movement provides an important case study in terms of maturation of environmental movement and dynamics related to politics of development. No other development project in India has brought into focus the magnitude of eco-development problems to such a level of informed debate, political mobilization and grass root activism as this project. The controversy which surrounded this project has challenged the government at all levels and at the same time was successful in creating and forging linkages with civil society organization and NGOs, both at the national and international level. In fact, it has contributed to the political discourse of alternative development in India (Narula, 2008).

The construction of dam on river Narmada surfaced as early as 1946. In fact, Prime Minister Jawaharlal Nehru laid its foundation in 1961. However, the states- Gujarat, Madhya Pradesh and Maharashtra, were unable to decide on a suitable water distribution policy. In 1969, the government created the Narmada Water Disputes Tribunal to restore the conflict and get the project underway. Ten years later, the Tribunal reached a consensus and the Narmada River -Valley Project was born. The project which covers three major states of western India, namely, Gujarat, Madhya Pradesh and Maharashtra, envisioned the transformation of Narmada river and her 41 tributaries into a series of reservoirs by 3,200 dams including two mega dams- the Sardar Sarovar in Gujarat and the Narmada Sagar in Madhya Pradesh-as well as 30 major dams, 135 medium dams and thousands of small dams. The Indian government promised that the dams would help provide potable water for almost forty million

people, irrigation for over six million hectares of land, and hydroelectric power for the entire region (Kumar, 2006).

The Sardar Sarovar Project (SSP) in the state of Gujarat includes the most controversial large dam. It was originally conceived only as an irrigation project of a 161 feet high dam. Later it was found that water could be technologically harnessed making it a multipurpose dam if its level is raised to 455 feet. The government claimed that the Sardar Sarovar dam alone would irrigate almost 1.8 million hectares of land in Gujarat and an additional 73,000 hectares in the dry neighboring state of Rajasthan, in addition to providing potable water to over 8,000 Gujarati villages and 135 urban centers. These benefits, however, would come at a high cost, including the displacement of thousands of individuals and considerable environmental damage. According to the Hindu Survey of Environment (1991), the construction of the Sardar Sarovar and Narmada Sagar Projects would mean that over three lakh people of the Narmada valley would be evicted from the centuries old land of their ancestors. According to official figures, these projects (if continued), would submerge about 1, 30,482 hectares of land, of which 55,681 hectares is prime agricultural land and 56,066 hectares forests. Apart from this direct submergence, there is also the land which would be required for cultivation, fuel and timber for displaced human population and for grazing by the massive numbers of livestock. In addition to this, according to the Ministry of Environment and Forests, the environmental cost of loss of forests due to the Narmada Sagar Project (NSP) will be Rs. 30,923 crores and that due to the Sardar Sarovar Project Rs. 8,190 crores. The Forest Conservation Advisory Committee of the Ministry demanded in January 1990, that the work on the project be halted immediately as it violated specific guidelines. The Committee said that the ecological balance of the area would be seriously affected due to the cutting down of

80 million trees at one go. The climate in the area will change, the rain cycle will be upset and the vital oxygen content in the air in and around the area will decrease. In fact, according to the critics, it is seen as "the world's worst man-made ecological disaster" (Bhaskaran, 1990).

Despite these foreseeable consequences, and in the absence of consultation with indigenous communities that would experience the environmental impact and involuntary displacement, in 1985, the World Bank agreed to finance the Sardar Sarovar dam to the tune of $450 million, approximately 10% of the total cost of the project. In response, local opponents, environmental activists, and professionals from the academic, scientific, and cultural worlds founded a group of non-governmental organizations (NGOs). These groups gained strength in the late 1980s and came together to form the Narmada Bachao Andolan (NBA), or the Save Narmada Movement. Led by the legendary activist Medha Patkar, the NBA employed creative means of resistance to mobilize opposition to the Sardar Sarovar Project. In 1988, the NBA demanded formally the stoppage of all work on the Narmada Valley Development Projects. In September 1989, more than 50,000 people gathered in the valley from all over India to pledge to fight "destructive development". A year later thousands of villagers walked and boated to a small town in Madhya Pradesh to reiterate their pledge to drown rather than agree to move from their homes. On the national front, the NBA opposed the dam and proposed various development alternatives, including decentralized methods of water harvesting. Internationally, the NBA led the charge to demand World Bank accountability for its involvement in a project that threatened to harm millions. Their campaign led to the creation of a Bank commission in 1991 to independently review the project, which ultimately recommended the Bank's withdrawal. Citing human rights concerns that reached far

beyond the Sardar Sarovar dam, and focusing on the participation of those most directly affected, the review concluded that "unless a project can be carried out in accordance with existing norms of human rights norms espoused and endorsed by the Bank and many borrower countries, the project ought not to proceed". Eventually, due to the international uproar created by the Report, the World Bank withdrew from the Sardar Sarovar Project. Furthermore, the controversy surrounding the dam led directly to the creation of the World Bank Inspection Panel in 1993. It was a milestone for the human rights movement and the first mechanism established to enable local groups to challenge World Bank projects (Reddy, 1998).

Although the movement was originally started as a struggle for just resettlement and rehabilitation of people being displaced by the Sardar Sarovar Dam, its focus has shifted to preserving the environmental integrity and natural ecosystems of the entire valley. Although many issues of the project are yet unresolved, it has been successful to a considerable extent. It has been successful not only in mobilizing thousands of people under different walks of life to put pressure on the state government for its anti-people policies, affecting and displacing lakhs of tribals from their homes and livelihoods, but also received immense international support. The achievements of the movement include- exit of the World Bank from Sardar Sarovar in 1993, halt of Sardar Sarovar construction in 1993 and withdrawal of foreign investors from Maheshwar dam. In addition to this, the movement is considered as the most popular movement in environmental history of India for influencing judicial decision on environmental governance. In May 1994, the NBA filed a PIL (Public Interest Litigation) against the project in the Supreme Court under Article 32 of the Indian Constitution. Though the NBA petition was dismissed and in 2000 the Court allowed the dam to be built to its full height of 138 metres, the NBA was able to

influence judiciary decision in terms of evolution of various new policies relating to environmental protection. The National Rehabilitation Policy is one of the important outcomes of this case (Sahu, 2007).

Thus, the Narmada Bachao Andolan (NBA) has not only made an international impact, it has also led to the formation of a national level campaign against large dams. The activities of NBA are not simply restricted to the question of rehabilitation of the people affected, they have also raised fundamental questions about the model of development, whose interests are served through such projects and the accountability of the state and multilateral aid agencies such as the World Bank towards human rights and environmental issues in the host countries. According to one NBA activist, the campaign against the construction of dams on the Narmada River is "symbolic of a global struggle for social and environmental justice". It is a "symbol of hope for people's movements all over the world that are fighting for just, equitable, and participatory development". Specifically, it forced consideration of the ecological viability and social impacts of large-scale projects (Kumar, 2006).

6.2.5 Movement against Limestone Quarrying in Doon Valley

Another movement which arose due to the degradation of local environment was the movement against the limestone quarrying in the Doon Valley. The intensification of limestone mining in the valley since 1947 has led to considerable environmental degradation.-deforestation, drying up of water resources, and the laying waste through erosion and remains of previously cultivated fields (Bandyopadhyay and Shiva, 1985). However, opposition to this destructive economic activity gathered force only in late 1970s and early 1980s. It came up from two distinct sources. On the one side, retired officials and executives of the locality

formed the 'Friends of the Doon' and the 'Save Mussoorie' committees to safeguard the habitat of the valley. They were joined by hotel owners in Mussoorie, who were worried about the impacts of environmental degradation on the tourist in-flow in this well known 'hill station'. On the other side, villagers more directly affected by mining were organized by local activists, many of whom had played major role in the Chipko movement. Later, both wings were collaborated in a PIL (Public Interest Litigation) that resulted in a landmark judgment of the Supreme Court, recommending the closure of all six limestone mines in the Doon Valley (Bandyvopadhyay, 1989; Dogra *et al.*, 1983).

Conclusion

The Chipko, Appiko, Narmada and the other environmental movements discussed above were people's response against the destructive pattern of development. These movements revealed how the resource intensive demands of development built in ecological destruction and economic deprivation of local communities living in and around forests. They became an instrument to fight against social-injustice, improper developmental planning and faulty environmental policies. Apart from social equity, the movements also raised the fundamental issue of ecological balance demanding the restoration of balance between development and environment. They created mass awakening among the villagers about the ecological danger posed by the commercial and industrial interests to the forests, the main source of their sustenance. Apart from criticizing destructive pattern of development, they strongly advocated the revival of traditional 'self sufficient village economy'.

An important feature of these movements is that they brought communities to the centre stage of Indian environmental discourse. People's concern for environment

continued to remain high over the years. They continued to raise questions on the status of different policies concerning environmental protection. This kind of growing awareness among people about their right to a wholesome healthy environment had been able to pressurize the policy makers to consider environmental issues while formulating developmental policies. For instance, the Chipko movement had been successful in forcing a fifteen-year ban on commercial green felling in the hills of Uttar Pradesh, in stopping clear felling in the Western Ghats and the Vindhyas, and in generating pressure for a national forest policy which is more sensitive to the people's needs and to the ecological development of the country. In many watersheds, the denuded forest cover had been reclaimed, biomass production had gone up and lost prosperity was gradually being reclaimed. Similarly, the Appiko movement forced the Government to change some aspects of its forest policy, felling of natural forests in the Western Ghats was stopped and the Government itself stopped felling green trees for revenue. Thus, the movements which primarily involved villagers and local communities achieved a considerable amount of success in reducing the large scale destruction of forests, protecting the existing forest cover and regenerating trees in denuded land.

While examining the significance of environmental movements on environmental protection in India, Sinha (1998) argues that with the emergence of environmental movements there is a change in the political and economic attitudes and practices in several important ways. Modifications to social cost-benefit analysis, the onset of environmental impact assessment and environment auditing, risk analysis, public inquiries, new legislative measures, plus the successful political-legal activities of non-governmental groups have all helped to give policies and actions an environmental color. Similarly, there are scholars like Kohli (1994) who strongly

argues that the evolution of environmental governance in India is because of the emergence of societal forces in general and environmental movements in particular. The emergence of societal forces in the early 1970s challenged the state-centric development policy. Among the societal forces, environment movements challenged the ideology of economic development which had not taken environment factors into consideration. The ideology of economic development, which remained almost monolithic in the first two decades of policymaking process, faced a major foundational challenge from the environmental groups.

Chapter - 7

Summary and Conclusion

SUMMARY AND CONCLUSION

The present study is an effort to examine the status of India's environment and forests as well as to examine the efficacy of various legislative as well as administrative measures that have been taken by the Government of India for environment and forest management in the country.

India's environment as reflected in its land, air and water resources was found to be considerably degraded. India is suffering from different types of land degradation. In 2005, about 44.7% of land area of the country was found to be degraded. A number of factors such as fuelwood and fodder extraction, encroachment on forests, grazing, and forest fires, indiscriminate use of agro-chemicals, inappropriate irrigation system, etc. have been responsible for land degradation in India. Besides this, India has also been facing the severe problem of air and water pollution. The country-wide ambient air quality monitoring carried out by the Central Pollution Control Board (CPCB) in 2008 at 346 monitoring stations, revealed that National Ambient Air Quality Standard (NAAQS) for Particulate Matter, the main air pollutant of public health concern, were violated at most of the monitoring stations in both industrial and residential areas. As far as water pollution is concerned, it was observed that about 70 percent of the country's surface water and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic and inorganic pollutants. This degraded water quality contributed to water scarcity by limiting its availability for both human use and for the ecosystem.

The status of forests in India was not satisfactory. It was observed that despite of having great significance in Indian economy, they were one of the country's most mismanaged resources. As per the State of Forest Report (SRF) 2011, the forest cover

of the country was 69.20 million hectare (mha). However, it constitutes only 21.05% of total land area which was far below the national goal (National Forest Policy 1988) of 33% of forest cover. Apart from this, out of total forest cover of 21.05%, only 12.3% of forests are under dense forests with high ecological value.

The trend / changes in the forest cover over the period from 1989 to 2011 were examined by dividing the data into two time periods- Period A (1989-1999) and Period B (2001-2011). While forest cover and its different components, i.e. dense forest and open forest were found to decline marginally during Period A, a significant increase was recorded in forest cover as well as in open and dense forest cover during Period B. For instance, the total forest cover which was declined by 2841 mha (0.4) during Period A, recorded an increase of 38129 mha (5.5%) during Period B. Similarly, the dense and open forests, which were declined by 1112 mha (0.3%) and 2345 mha (0.9%) during Period A, recorded an increase of 9038 mha (2.2%) and 29091 mha (10.1%) respectively during Period B. However, it was observed that this increase in forest cover was not because of increase in native forests, but it was mainly due to the addition of tree plantations (tree crops, such as agroforestry plantations, fruits orchards, tea and coffee estates with trees, etc.) or 'artificial forests' in the total forest cover since 2001. As these tree plantations cannot perform various socio-economic and ecological functions of forests, they cannot be considered as actual forests.

Apart from these, forests were found to be under severe biotic pressure and were increasingly being degraded due to a range of human and biophysical causes. It was found that the huge demand and supply gap of forest products resulted in the unsustainable extraction of forest resources in India. Despite the regulation of diversion of forest lands for non-forestry purposes by the Forest Conservation Act

(FCA) 1980, large areas of forest lands were still being diverted for agriculture as well as for other developmental purposes. The forests are also degraded due to several other anthropogenic pressures like over and unregulated grazing, shifting cultivation and vulnerability to forest fires and so on. Athough, the area under forests was increasing, the quality of the forest stock was not improving. Degradation of natural forests due to several factors remained a major concern for management of forest.

It was also observed that despite making significant contribution to India's economic and ecological systems, India's forests were not been given due recognition in the national accounts. The current approach for accounting of forestry sector contribution to GDP grossly under-estimated their contribution to the national economy due to insufficient accounting of tangible benefits of forests, non-recording of intangible benefits, non-recording of unauthorized extraction and insufficient recordings of losses in the forests. As a result of this, the value of forests reflected in the System of National Accounts (SNA) represents less than 10% of its real value. The availability of adequate data and information relating to India's forests was another major concern of India's forestry sector. The statistical reporting in the forest sector did not meet national as well international requirements. There was no reliable assessment of the growing stock of trees at state level. Other deficits included a lack of data on different products of forests and non-availability of separate information on the area under plantations as well as on natural forests. It was difficult to make economic assessments and set policies without quality data and information on both the tangible and intangible benefits of forests. Thus, the current information was below the requirements to support sustainable forest management.

The systematic management of forests in India was started during the British period in the mid-nineteenth century. The first forest policy of India was enunciated in

1894. However, the policy was directed towards commercial interests and gave priority to the development of agriculture, which was a major source of revenue. The policy was revised by the Government of India in the post-independence period and was adopted as the National Forest Policy of 1952. The policy emphasized on both productive as well as protective functions of forest and stipulated the need to bring one-third (33%) of the forest area under forest cover. However, no apparent attempt was made to increase the forest cover as well as to enhance the protection of forests. Forests were viewed as a source of revenue as well as raw materials for various forest based industries.

However, even after the enunciation of the National Forest Policy of 1952, matters did not change on the ground. The policy reiterated the principles of colonial forestry, as enshrined in the earlier forest policy resolution of 1894, and reinforced the exclusive rights of the state with regard to the management and control of forest resources. The State, while upholding its executive control over forest protection and management, encouraged industrial expansion by providing powerful financial incentives to forest based industries. The subsidization to forest based industries led to the rapid expansion in the demand of various forest products. Further in 1976, the National Commission on Agriculture (NCA) suggested large scale industrial plantations on state forest lands, which included large-scale replacement of mixed natural forests of low-commercial value with fast growing commercially important plantation species.

In the mid 1970's, forest protection initiatives by local communities emerged across India in the form of various movements such as Chipko, Appiko, etc. The local communities raised their voice against the destructive pattern of development. The movements have been an instrument to fight against social injustice, improper

development planning and faulty environmental policies. They raised the fundamental issue of ecological balance, demanding the restoration of balance between development and environment. The local communities challenged the ideology of economic development which had not taken environmental factors into consideration. The movements which primarily involved villagers and local communities achieved a considerable amount of success in reducing the large scale destruction of forests, protecting the existing forest cover and regenerating trees in denuded land.

A major shift in the post-independence forest management regimes occurred with the enunciation of Forest (Conservation) Act in 1980. The Act was enacted to regulate the large scale diversion of forest land for non-forest purposes. However, it failed to provide a blanket ban on such diversion. As a result, large tracts of forests have continued to be diverted for agriculture, mining, as well as for development purposes, like dams causing destruction of forests. Besides, the law was also blamed for curtailing the rights of local communities. In 1988 a new National Forest Policy was initiated by the Government of India, which marked a major departure from 1952 policy by laying prime emphasis on environmental stability and conservation of forests, while meeting the domestic requirements of fuelwood, fodder and minor forest produce for rural and tribal population. The policy was implemented by involving local communities in the conservation, protection and management of forests through Joint Forest Management (JFM) institutions in 1990.

JFM was regarded as an effective tool for improving the condition of forests in the country. The programme was successful in raising plantations on non-forest as well as on degraded forest lands. It was observed that till 2010, about 24.6 mha of forest area was brought under this programme with 112,896 JFM committees engaged in forest plantations. However, one major shortcoming of the programme was that it

mainly concentrated on degraded forests (open forests) and did not cover the area under dense forests. However, the new guidelines issued by the Ministry of Environment and Forests (MoEF) in 2000, emphasized on the extension of the programme to good forest lands.

Another important policy decision regarding forests has been the passing of the Forests Rights Act in 2006. The Act was passed for the protection of tribal rights as well as for the conservation of forest resources. However, there were many institutional as well as administrative bottlenecks on the implementation of the Act. Besides, there were faulty provisions in the Act, which encouraged illegal encroachment and led to the disruption of the ecosystem.

It was observed that while the management of forests received the attention of policymakers' right from the beginning of national planning in India, environmental management was totally overlooked during the first two decades after independence. Serious legislative and administrative efforts for the protection of environment were started in India only after the Stockholm Conference in 1972. For instance, two major Acts- the Water (Prevention and Control of Pollution) Act 1974 and the Air (Prevention and Control of Pollution) Act 1981 were enacted to control water and air pollution respectively. Later, the Environment (Protection) Act was passed in 1986 to empower the Central Government to control pollution and protect the environment. However the efficacy of these enactments was doubtfully on account of their weak enforcement.For instance, in India, the Central Pollution Control Board (CPCB) and the State Pollution Control Board (SPCB) have been empowered for implementing legislations relating to prevention and control of pollution. However, insufficient coordination between these institutions, lack of compliance and enforcement of policies, and significant human and technical capacity constraints, did not allow the

system to function effectively. This result in the lack of enforcement of various pollution control laws (CAEP-TERI, 2011). As a result, the quality of natural resources like water and air has continued to deteriorate.

Since 1990s, the Government of India's policy towards environment was guided by the principles of Agenda 21, which was adopted at the Earth Summit held at Rio de Janeiro in 1992. Consequently, a number of policy statements and notifications were issued by the Government of India for integrating environmental concerns in the development process. These included, Policy Statement for Abatement of Pollution (PSAP) 1992, National Conservation Strategy and Policy Statement on Environment and Development (NCS-PSED) 1992 and Environmental Impact Assessment (EIA) notification 1994. The PSAP advocated the need for combining regulatory instruments with market-based instruments and various supportive measures to deal with environmental protection. It recommended the 'polluter pays principle', involvement of the public in decision-making and new approaches for market choices to give industries and consumers clear signals about the cost of using environmental and natural resources. In 2006, National Environment Policy was also initiated for mainstreaming environmental concerns in economic and social development and conserving environmental resources.

Apart from these, Government of India's concerns for environment and forests also found reflection in India's national Five Year Plans. Various environmental problems such as deforestation, forest degradation, soil erosion, loss of biodiversity as well as water and air pollution were addressed through programmes and schemes launched over the years. A number of institutions were also set up by the government to address these issues. One of the important objectives in the forestry sector was to enhance the status of forest cover to meet the national goal of 33% of land area.

Accordingly, a number of afforestation programmes (agro-forestry, farm forestry, social forestry and JFM) were launched. Consequently, the area under afforestation increased from merely 0.52 lakh hectares in the First Plan, 12.21 lakh hectares in the Fifth Plan to 88.63 lakh hectares in the Seventh Plan, but dropped to 80.50 lakh hectares during the Ninth Plan. However, it was observed that forest plantations during the first five national development plans were characterized by monocultures of quick growing species (teak, eucalyptus, etc.) which were created by clear felling of existing mixed natural forests and thus compromised both ecological and survival needs for short term gain.

It was also found that the forests of the country did not get due allocation of outlays under various Five Year Plans. Although the share of forestry and wildlife sectors to the total plan outlay has increased substantially through successive plans, it remained below 1% till the Sixth Five Year Plan. It was only in the Seventh Plan, that the allocation under forestry and wildlife sectors increased above 1%. However, after crossing the 1% barrier in the Seventh (1.03%) and Eighth (1.13%) Plans, it again slipped to below 1% in the Ninth (0.95%) and Tenth (0.94%) Five Year Plans.

Similarly, in the environment sector, a number of pollution control programmes such as Ganga Action Plan (GAP), National River Conservation Plan (NRCP), National Lake Conservation Plan (NLCP), etc. were initiated during the plans. However, these programmes largely failed to provide the required results due to weak monitoring and implementation.

Thus, from the above observations, it can be concluded that even after four decades a modern environmental regime in India, state of India's environment and forests continue to be a matter of concern. Overall efforts lacked effectiveness and

efficiency, largely as result of implementation gap. For instance, despite the presence of an extensive legal and regulatory framework, consisting of a number of laws and acts regarding environment and forest management, enforcement remained a key concern. While pollution control laws were characterized by lack of coordination among the implementing agencies and thereby weak monitoring of pollution control measures, laws regarding forests and wildlife were criticized as they did not address the livelihood security of local communities. Indeed, these laws were continuation of the colonial model in which the state and those close to it benefitted from resource use and conservation, while communities closest to resources had to pay the cost of reduced access.

The limited application of environmental laws in India undermined the effectiveness of important environmental initiatives. Besides these, the low level of investment on environment and forest sectors due to their undervaluation in economic and social terms was another major issue of natural resource management in India. Thus, the Government of India's initiatives regarding environment and forest management failed to bring the desired outcomes in tackling various environmental problems in the country. Consequently, environmental problems such as degradation of forests and soil, widespread biodiversity losses, falling water tables and deteriorating air quality still continue to plague the economy. Surging production, consumption, changing lifestyles and growing population, especially in urban areas have continuously challenged nature's ability to meet growing demands. Since, a majority of population in India depends on natural resources, especially on forests, for their subsistence; the large scale depletion of these resources may pose a threat to country's food security.

Findings of the Study

The main findings of the study are as follows :

1. India's environment as reflected in its land, air and water resources was considerably degraded.

2. The increase in India's forests during the last decade (i.e. from 2001 to 2011) was not because of increase in native/ natural forests, but was mainly due to the addition of tree crops and plantations such asagroforestry plantations, fruits orchards, tea and coffee estates with trees, etc. (which are actually not forests) in the total forest cover of the country.

3. While the quantitative decline in forests in India was arrested due to the addition of artificial forests in the forest cover, the quality of existing forests was still deteriorating due to a number of biotic and abiotic factors such as widening gap between demand and supply of forest products, diversion of forest land for non-forest purposes, encroachment, grazing, etc.

4. There was gross underestimation of the contribution of forests in the national income of the country due to weak system of natural resource accounting in India.

5. There was low plan investment on environment and forests as compared to other sectors of the economy.

6. There was weak enforcement and implementation of various laws and policies regarding environment and forest management in India.

Recommendations

On account of above observations, following recommendations can be made:

1. Resources are scarce and there is need to use them efficiently on sustainable basis. Environment and Forest sectors should be inculcated in the development process holistically.

2. Database on forests should be strengthened to make forest planning more effective.

3. There must be separate data on plantations as well as on natural forests in the forest cover assessments to reflect-actual changes in forest cover of the country

4. There should be proper accounting of various ecosystem goods and services provided by forests to access the true contribution of forests to the economy.

5. There should be reorientation of existing legislations on environment and forests and necessary provisions should be made to make them more stringent in their implementation.

6. The polluters should be made to pay equal to the amount of pollution through increased use of market instruments.

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Appendices

Appendix I

National Ambient Air Quality Standards (NAAQS)

Pollutant	Time Weighted Average	Concentration in Ambient Air ($\mu g/m^3$)		
		Industrial Area	Residential, Rural and Other Areas	Sensitive Areas
Sulphur Dioxide (SO_2)	Annual Average*	80 $\mu g/m^3$	60 $\mu g/m^3$	15 $\mu g/m^3$
	24 Hours Average**	120 $\mu g/m^3$	80 $\mu g/m^3$	30 $\mu g/m^3$
Oxides of Nitrogen (NO_2)	Annual Average*	80 $\mu g/m^3$	60 $\mu g/m^3$	15 $\mu g/m^3$
	24 Hours Average**	120 $\mu g/m^3$	80 $\mu g/m^3$	30 $\mu g/m^3$
Suspended Particulate Matter (SPM)	Annual Average*	360 $\mu g/m^3$	140 $\mu g/m^3$	70 $\mu g/m^3$
	24 Hours Average**	500 $\mu g/m^3$	200 $\mu g/m^3$	100 $\mu g/m^3$
Respirable Particulate Matter (RPM)	Annual Average*	120 $\mu g/m^3$	60 $\mu g/m^3$	50 $\mu g/m^3$
	24 Hours Average**	150 $\mu g/m^3$	100 $\mu g/m^3$	75 $\mu g/m^3$
Lead (Pb)	Annual Average*	1.0 $\mu g/m^3$	0.75 $\mu g/m^3$	0.50 $\mu g/m^3$
	24 Hours Average**	1.5 $\mu g/m^3$	1.0 $\mu g/m^3$	0.75 $\mu g/m^3$
Carbon Monoxide (CO)	8 Hours Average**	5.0 mg/m^3	2.0 mg/m^3	1.0 mg/m^3
	1 Hour Average	10.0 mg/m^3	4.0 mg/m^3	2.0 mg/m^3
Ammonia (NH_3)	Annual Average*			0.1 mg/m^3
	24 Hours Average**			0.4 mg/m^3

Source: Central Pollution Control Board, 2008

*Annual Arithmetic Mean of minimum 104 measurements in a year twice a week ,24 hourly at uniform interval.

**24 hourly/8 hourly values should be met 98% of time in a year. However, 2% of the time, it may exceed, but not on two consecutive days.

NOTE- National Ambient Air Quality Standard: The levels of air quality necessary with an adequate margin of safety, to protect the public health, vegetation and property.

Appendix II

Growth of Installed Generation Capacity in India

Year	Hydro	% of Total	Thermal					Nuclear	% of Total	RES	% of Total	Grand Total
			Coal	Gas	Diesel	Total	% of Total					
1950	560	32.69	1004	0	149	1153	67.3	0	0	0	0	1713
1961	1917	41.19	2436	0	300	2736	58.8	0	0	0	0	4653
1970	6966	41.8	8652	165	241	9058	54.35	640	3.84	0	0	16664
1980	11384	40.01	15991	268	165	16424	57.73	640	2.24	0	0	28448
1990	18307	28.76	41236	2343	165	43764	68.77	1565	2.45	0	0	63636
1997	21658	25.24	54154	6562	2947	61010	71.11	2225	2.59	902	1.05	85795
2002	26269	25	62131	11163	1135	74439	70.86	2720	2.58	1628	1.54	105046
2003	26767	24.81	63951	11633	1178	76762	71.16	2720	2.52	1628	1.5	107871
2004	29507	26.18	64957	11840	1172	77969	69.19	2720	2.41	2488	2.2	112684
2005	30942	26.12	67791	11910	1202	80903	68.31	2770	2.33	3811	3.21	118426
2006	32326	26	68518	12690	1202	82410	66.3	3360	2.7	6191	4.98	124287
2007	34654	26.18	71121	13692	1202	86015	65	3900	2.94	7760	5.86	132329
2008	35909	25.1	76049	14656	1202	91907	64.24	4120	2.87	11125	7.77	143061

Source: Compendium of Environment Statistics- India, 2010.

Appendix III

Primary Water Quality Criteria for Various Uses of Fresh Water

Designated Best Use	Class	Criteria
Drinking water source without conventional treatment but without disinfections	A	*Total Coliform organisms MPN/100ml shall be 50 or less. *pH between 6.5 and 8.5. *Dissolved oxygen 6 mg/l or more. *Biochemical Oxygen Demand (BOD) 2 mg/l or less.
Outdoor bathing (organized)	B	*Total Coliform Organisms MPN/100ml shall be 500 or less. *pH between 6.5 and 8.5. *Dissolved Oxygen 5 mg/l or more. *Biochemical Oxygen Demand (BOD) 5 mg/l or less.
Drinking water source with conventional treatment followed by disinfections	C	*Total Coliform organisms MPN/100ml shall be 5000 or less. *pH between 6 and 9. *Dissolved oxygen 4 mg/l or more. *Biochemical Oxygen Demand (BOD) 3 mg/l or less.
Propagation of Wildlife, Fisheries	D	*pH between 6.5 and 8.5. *Dissolved oxygen 4 mg/l or more. *Free ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial cooling, Controlled waste disposal	E	*pH between 6.0 and 8.5. *Electrical conductivity less than 2250 micro mhos/cm *Sodium absorption ratio less than 26. *Boron less than 2 mg/l.

Source: Central Pollution Control Board, 2009.

Appendix IV

State wise Forest Cover in India 2011

State/ UTs	Total Geographical Area		Forest Cover		Dense Forest		Open Forest		Per Capita Forest Area (Km^2)
	Area (Km^2)	%	Area (Km^2)	% of TGA	Area (Km^2)	% of FC	Area (Km^2)	% of FC	
Andhra Pradesh	275069	8.37	46389	16.9	27092	58.4	19297	41.6	0.05
Bihar	94163	2.86	6845	7.27	3511	51.3	3334	48.7	0.01
Delhi	1483	0.05	176	11.9	56	31.8	120	68.2	-
Goa	3702	0.11	2219	59.9	1128	50.8	1091	49.2	0.15
Gujarat	196022	5.96	14619	7.46	5607	38.4	9012	61.6	0.02
Himachal Pradesh	55673	1.69	14679	26.4	9605	65.4	5074	34.6	0.21
Jammu & Kashmir	222236	6.76	22539	10.1	12900	57.2	9639	42.8	0.18
Karnataka	191791	5.83	36194	18.9	21956	60.7	14238	39.3	0.06
Kerala	38863	1.18	17300	44.5	10836	62.6	6464	37.4	0.05
Madhya Pradesh	308245	9.38	77700	25.2	41626	53.6	36074	46.4	0.11
Maharashtra	307713	9.36	50646	16.5	29551	58.4	21095	41.7	0.05
Orrisa	155707	4.74	48903	31.4	28426	58.1	20477	41.9	0.12
Punjab	50362	1.53	1764	3.5	736	41.7	1028	58.3	0.01
Rajasthan	342239	10.4	16087	4.7	4520	28.1	11567	71.9	0.02
Tamil Nadu	130058	3.96	23625	18.2	13269	56.2	10356	43.8	0.03
Uttar Pradesh	240928	7.33	14338	5.95	6185	43.1	8153	56.9	0.01
West Bengal	88752	2.7	12995	14.6	7630	58.7	5365	41.3	0.01
Haryana	44212	1.34	1608	3.64	484	30.1	1124	69.9	0.01
Sikkim	7096	0.22	3359	47.3	2661	79.2	698	20.8	0.55
Arunachal Pradesh	83743	2.55	67410	80.5	52387	77.7	15023	22.3	4.88
Assam	78438	2.39	27673	35.3	12848	46.4	14825	53.6	0.09
Manipur	22327	0.68	17090	76.5	6881	40.3	10209	59.7	1.57
Meghalaya	22429	0.68	17275	77	10208	59.1	7067	40.9	0.58
Nagaland	16579	0.5	13318	80.3	6224	46.7	7094	53.3	0.67
Tripura	10486	0.32	7977	76.1	4795	60.1	3182	39.9	0.22
Mizoram	21081	0.64	19117	90.7	6220	32.5	12897	67.5	1.75
Uttarakhand	53483	1.63	24496	45.8	18929	77.3	5567	22.7	0.24
Chhattisgarh	135191	4.11	55674	41.2	39074	70.2	16600	29.8	0.22
Jharkhand	79714	2.42	22977	28.8	12507	54.4	10470	45.6	0.07
Union Territories	9478	0.28	7035	74.22	6355.2	90.33	680.1	9.66	0.21
All India	3287263	100.0	692027	21.1	404207	58.4	287820	41.6	0.6

Source : State of Forest Report, 2011, Forest Survey of India
TGA- Total Geographical Area; FC- Forest Cover